

**SURVEY OF THE PELAGIC FISH RESOURCES OFF  
NORTH WEST AFRICA**

**Part I**

**SENEGAL - THE GAMBIA**

**27 June - 7 July 2003**

Centre de Recherches Océanographiques de Dakar-Thiaroye  
Dakar, Senegal

Institute of Marine Research  
Bergen, Norway

Department of Fisheries  
Banjul, the Gambia

CRUISE REPORTS 'DR FRIDTJOF NANSEN'

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NORTH WEST AFRICA**

**Part I**

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**27 June - 7 July 2003**

by

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Bergen, 2003**

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## CHAPTER 1 INTRODUCTION

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### 1.1 Objective of the cruise

The general objectives of the survey were to estimate biomass and map the distribution of small pelagic fish stocks off NW Africa (Morocco, Mauritania, Senegal and The Gambia) by hydro-acoustic methods and describe the hydrographic conditions there over a period of 50 days, in May-July 2003. For Senegal and The Gambia the agreed objectives were as follows:

- To map the distribution and estimate the biomass for the main small pelagic fish using hydro-acoustic methods. The species of interest were: sardinella *Sardinella aurita*, *Sardinella maderensis*, horse mackerel *Trachurus trachurus* and *T. trecae*, false scad *Decapterus rhonchus*, and anchovy *Engraulis encrasicolus*.
- To identify and describe the size distribution of the target fish populations by midwater and bottom trawl sampling and process the catches by recording weight and number by species.
- To collect otoliths of sardinella for later reading ashore.
- To sample standard hydrographical transects for temperature, salinity and oxygen at about 13°35' N and 14°50' N.

The time allocated for this part of the survey, off Senegal and The Gambia, was 9 days.

### 1.2 Participation

Participating scientists were:

Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT), Senegal:  
Abdoulaye SARRE, Mor SYLLA, Ibrahima SOW and Cheikh N'DOUR

Department of Fisheries (FD), The Gambia:  
Ebou Mass MBYE, Solomon TAMOH and Juldah JALLOW,

Institut Mauritanien de Recherches Océanographiques et des Pêches (CNROP), Mauritania:  
Diallo IBRA

Institute of Marine Research (IMR), Norway:

Reidar TORESEN, Magne OLSEN, Tore MØRK and Terje HOVLAND

### **1.3 Narrative**

The course tracks with the fishing and hydrographical stations are shown in Figure 1.

The survey started off St. Louis on June 28 with systematic parallel course tracks spaced about 10 NM (nautical miles) apart. To cover the whole distribution area of pelagic fish, the shelf was covered from the 15 m isobath and offshore to the 500 m isobath. Trawling was done irregularly, either to identify echo registrations or to check 'blindly' if fish were mixed with the plankton in the upper layers of the water column. Pelagic trawl with floats was often used to catch fish close to the surface. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). The shelf was covered from St. Louis to Casamance. The survey was completed in Dakar on July 7th.

The hydrographic profile off The Gambia was carried out on 2<sup>nd</sup> July and that off Cape Vert on 30<sup>th</sup> June.

### **1.4 Methods**

#### *Environmental Data*

Surface temperature and meteorological data from a weather station were logged automatically and recorded with position and bottom depth at every nautical mile.

Hydrographic profiles were collected with a Seabird 911+ CTD probe and temperature, salinity, oxygen and pressure (depth) were logged by the Seabird Software. From these data series, records were selected from standard depths and presented in figures.

#### *Biological sampling*

Biological sampling of the fish was carried out using trawls. A pelagic trawl with floats was often used. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). Annex II gives a description of the instruments and the fishing gear used. All catches were sampled for composition by weight and

numbers of each species caught. Species identification was based on the FAO Species Guides. Length frequency distributions, by total fish length in cm, of the selected target species were taken in all the stations where they were present. Individual weight measurements were taken regularly to estimate the condition factor in the length-weight relationship:

$$\bar{w} = \frac{cond}{100} \cdot L^3$$

The specific condition factors obtained from the samples and applied for this survey were: 0.96 for sardinellas and horse mackerels.

For the estimation of the biomass of carangids and associated species, an overall average length of 23 cm and a condition factor of 0.88 (to calculate the mean length of this length group) were applied.

All data on fishing stations and fish length sampling were made available to the participants on diskettes.

The complete records of fishing stations are shown in Annex I.

The following target groups were used for Senegal:

1. Sardinellas (flat sardinella *Sardinella maderensis* and round sardinella *S. aurita*),
2. Horse mackerels (Cunene horse mackerel *Trachurus trecae*, round scad *Decapterus punctatus*, and false scad *Caranx rhonchus*),
3. Other pelagic carangids and associated species (Atlantic bumper *Chloroscombrus chrysurus*, African lookdown *Selene dorsalis*, chub mackerel *Scomber japonicus*, largehead hairtail, *Trichiurus lepturus*, and barracudas *Sphyraena* spp.),
4. Other demersal species (such as bigeye grunt *Brachydeuterus auritus*, Sparidae and Haemulidae),
5. Other clupeids such as West African ilisha *Ilisha africana*.

#### *Acoustic sampling*

A SIMRAD EK500 Echosounder was used with the settings as shown in Annex II. The Bergen Integrator (BEI) was used for analysis and allocation of the integrated  $s_A$ -values to the individual specified target groups by 5 NM intervals. The allocation of values to target groups was based

on a combination of a visual scrutiny of the behaviour pattern as deduced from echo diagrams, the BEI analysis, and the catch compositions.

In cases where the target category of fish contains more than one species (sardinellas and horse mackerels), the mean  $s_A$ -value allocated to the category is divided between the species in the same ratio as their contribution to the mean back scattering strength in the length frequency samples.

The following target strength (TS) function was applied to convert  $s_A$ -values (mean integrator value for a given species or group of species in a specified area) to number of fish:

$$TS = 20 \log L - 72 \text{ dB}$$

Which can be converted (see Toresen *et al.* 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26 \cdot 10^6 \cdot L^{-2}$$

where  $L$  is total length in 1 cm length group  $i$  and  $C_{Fi}$  ( $\text{m}^{-2}$ ) is the reciprocal back scattering strength, or so-called fish conversion factor. In order to split and convert the allocated  $s_A$ -values ( $\text{m}^2/\text{NM}^2$ ) to fish densities (numbers per length group per  $\text{NM}^2$ ), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^n \frac{p_i}{C_{Fi}}}$$

where

$\rho_i$  = density of fish in length group  $i$

$s_A$  = mean integrator value

$p_i$  = proportion of fish in length group  $i$

$\sum_{i=1}^n \frac{p_i}{C_{Fi}}$  = the relative back scattering cross section ( $\text{m}^2$ ) of the length frequency

sample of the target species, and

$C_{Fi}$  = reciprocal back scattering cross section ( $\sigma_{\text{bs}}^{-1}$ ) of a fish in length group  $i$ .

The integrator outputs were split in fish groups using a combination of behaviour pattern as deduced from echo diagrams, the BEI analysis and catch composition as described below. The following groups were used for Senegal: 1) sardinellas, 2) horse mackerels, 3) carangids and associated species, and 4) demersal fish.

False scad (*Decapterus rhonchus*) was included in the horse mackerel group, thus a separate estimate of this species is done.

The above equations show that the conversion from  $s_A$ -values to number of fish is dependent on the length composition of the fish. It is therefore important to get representative length distributions from the stock in the whole distribution area.

When the size classes (of e.g. young fish and older fish) are well mixed, the various length distributions can be pooled together with equal importance. Otherwise, when the size classes are segregated, the total distribution area has to be post-stratified, according to the length distributions, and separate estimates are made for the regions containing fish with equal size.

For a region representing a distribution of a target-specie, the following basic data are needed for the estimation of abundance; 1) the average  $s_A$ -value for the region, 2) the surface (usually square nautical miles,  $NM^2$ ), and 3) a representative length distribution of the fish in the region. If the targeted fish is a mixture of more than one species, for example sardinellas, a representative distribution of the two, within the region, as shown in the trawl catches, are used. A length distribution representing the number of the two species for each catch will have to be calculated. Thereafter, these distributions have to be normalized to a unit number (usually 100) so they are equally weighted.

A systematic approach to a) divide the  $s_A$ -value between species in a category of fish (e.g. *Sardinella aurita* and *S. maderensis*) and b) produce pooled length distributions of a target species for use in the above equation and c) calculate the biomass estimates for a region, is obtained through the following procedure:

- The samples of the species in the category (e.g. sardinellas) are respectively pooled together with equal importance (normalized).
- The mean back scattering strength ( $\rho/s_A$ ) of each length frequency distribution of the target species is calculated and summed. This is automatically done in the Excel spread-sheet made available for acoustic abundance estimation onboard RV “Dr. Fridtjof Nansen”, provided the data are punched in this sheet.



- The mean  $s_A$ -value allocated to the category of fish in the region is divided between the species in the same ratio as their relative contribution to the mean back scattering strength of the length groups in the sample representing the region (also automatically done in the Excel spread-sheet given that the  $s_A$ -value for the region is punched into the sheet).
- The pooled length distribution is used, together with the mean  $s_A$ -value, to calculate the density (numbers per square NM) by length groups and species, using the above formula. The total number by length group in the area is obtained by multiplying each number by the area. (This is done in the Excel spreadsheet, given that the area of the region is punched into the sheet).
- The numbers are converted to biomass using the estimated weight at length. (Done in the Excel sheet if the condition factor is punched).

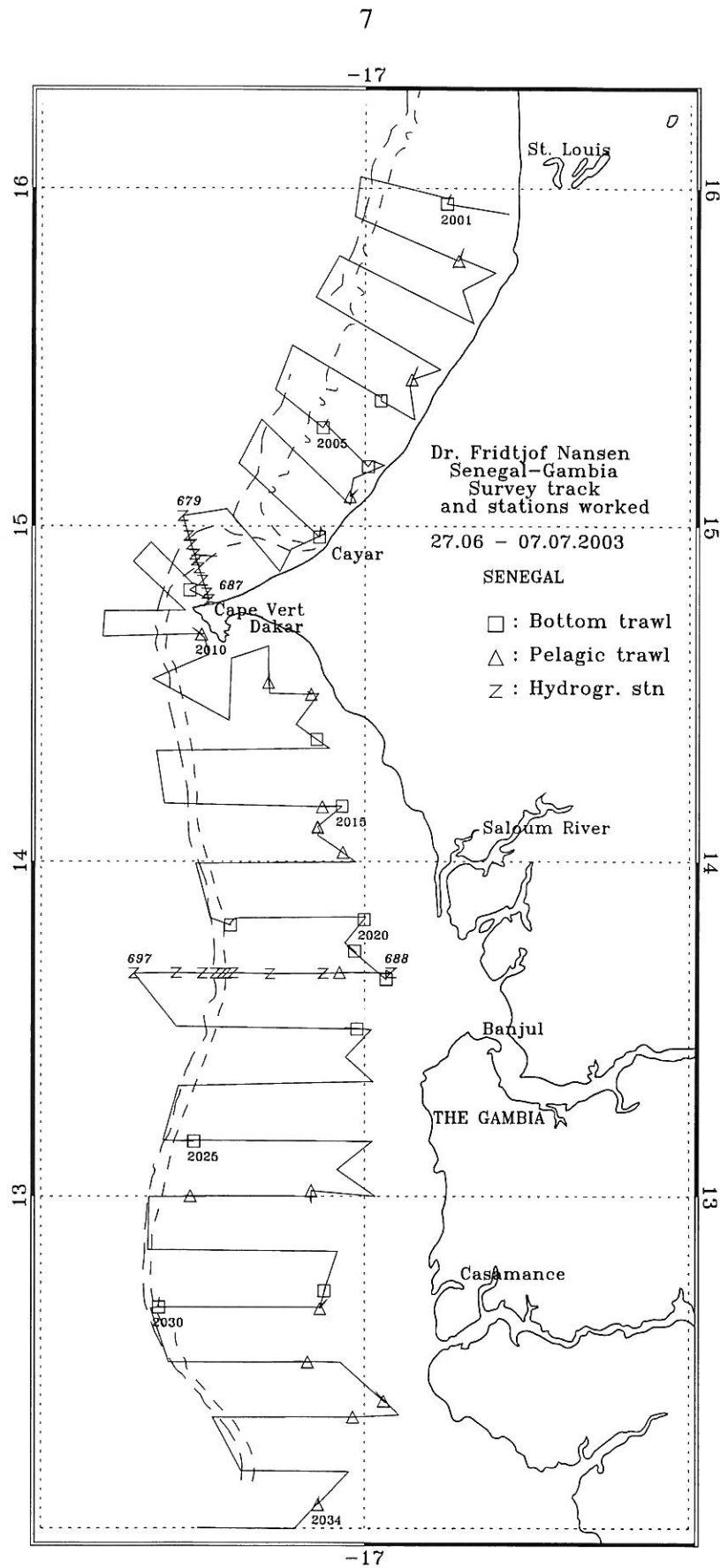
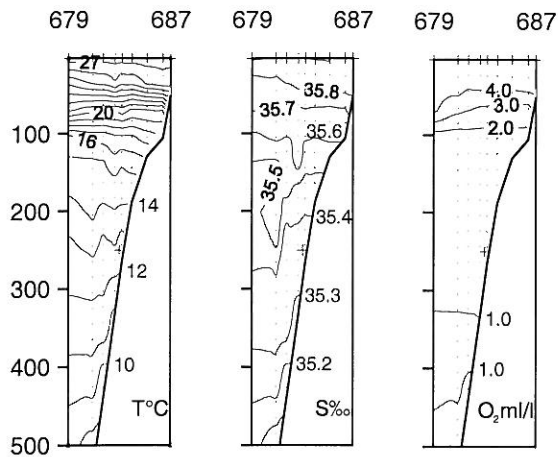


Figure 1. Course tracks with fishing and hydrographic stations; Casamance to St. Louis.

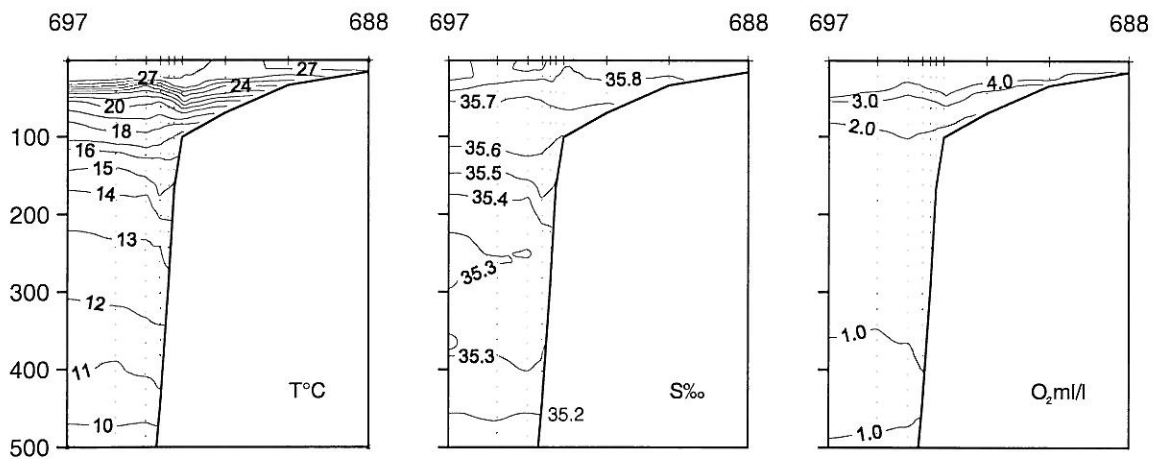
## CHAPTER 2 SURVEY RESULTS

### 2.1 Hydrography

Figure 2 shows the distribution of temperature, salinity and oxygen in the two profiles and Figure 3 the sea surface temperature at 5 m of depth.



CAPE VERT 30.06 2003



THE GAMBIA - WEST 02.07 2003

Figure 2. Hydrographic profiles with distribution of temperature, salinity and oxygen.

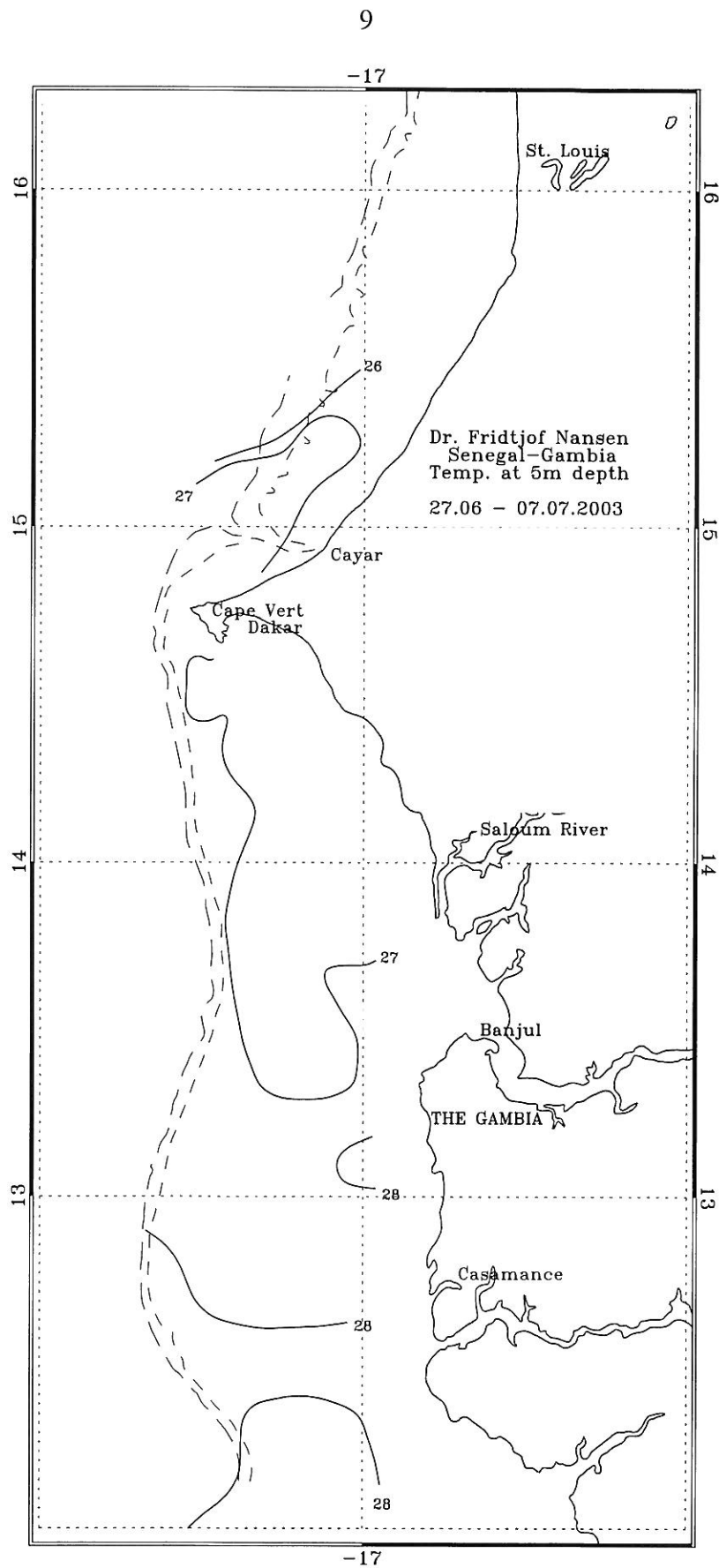


Figure 3. Sea surface temperature; Casamance to St. Louis.

The distribution of surface temperature and the profile the Gambia-west show that there was a stable surface layer with a temperature of 27-28 °C over the whole shelf south of Cape Vert. North of Cape Vert there was a trend of decreasing temperature towards the shore, with a decline from 27 °C over the entire shelf just north of Cape Vert to 26 °C off St. Louis.

## 2.2 The Casamance shelf

Figures 4, 5 and 6 show the distributions of the main groups of pelagic fish by contoured acoustic densities for the whole shelf of Senegal and The Gambia.

Off the Casamance coast, there were three school areas of sardinella of medium and high density in shallow waters, mostly inside the 50 m depth line, one in the southernmost part of the covered area, a smaller in the central parts, and the third at the boarder between Senegal and The Gambia, Figure 4. The samples from this aggregation were predominantly *Sardinella maderensis*. The modal size was 24 cm (total length). Estimated number and biomass by length-groups are in Annex IV. The total biomass of sardinellas in the area was estimated at 221 thousand tonnes, Table 1.

Horse mackerels were found over the outer parts of the shelf, in an aggregation with a distribution northwards into Gambian waters. Cunene horse mackerel (*Trachurus trecae*) dominated the total horse mackerel estimate in the area (72 thousand tonnes) by 96 %. Hence false scad (*Caranx rhonchus*) was estimated to merely 2 thousand tonnes. The modal length of the Cunene horse mackerel was 20 cm, while that of the false scad seemed to be young individuals of 8 cm, Annex IV.

Other pelagic fish were found over most of the shelf, see Figure 6. The trawl samples indicated that these consisted of bumper, lookdown, barracudas, two-colour jack and hairtails, with the bumper as the dominating species. The estimated biomass of this group of fish was 141 thousand tonnes.

Table 1. Casamance. Biomass estimates of pelagic fish, thousand tonnes.

Flat sardinella 221	Round sardinella -	Horse mackerels 72	Carangids etc. 141
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### 2.3 The Gambian shelf

The school area of sardinella found at the southern boarder between The Gambia and Senegal did only in a very small extent continue northwards into the Gambian zone, Figure 4. In other parts of the Gambian waters no sardinellas were found. Therefore, the estimate of sardinellas in the Gambian waters during this survey is very low (18 thousand tonnes), see Table 2. The concentrations were flat sardinella (*Sardinella maderensis*) and the modal length was 24 cm, see Annex IV. The estimated number and biomass by length-groups are in Annex IV.

The distribution of horse mackerels, which were found in Casamance, continued into the Gambian waters and was found over major parts of the shelf, Figure 5. However, the densities were not very high and the biomass estimated at 29 thousand tonnes only. Also in The Gambia there was a mixture of *Trachurus trecae* and *Caranx rhonchus*, and the latter dominated the total biomass by 93%. The modal lengths of false scad were 12, 23 and 32 cm, while that of Cunene horse mackerel was 12 cm.

Carangids and associated species were found widely distributed over the shelf, Figure 6. Catches of this group consisted mainly of Atlantic bumper, African lookdown and barracudas. The biomass was estimated at 15 thousand tonnes.

Table 2. The Gambia. Biomass estimates of pelagic fish, thousand tonnes.

Flat sardinella 18	Round sardinella -	Horse mackerels 29	Carangids etc. 15
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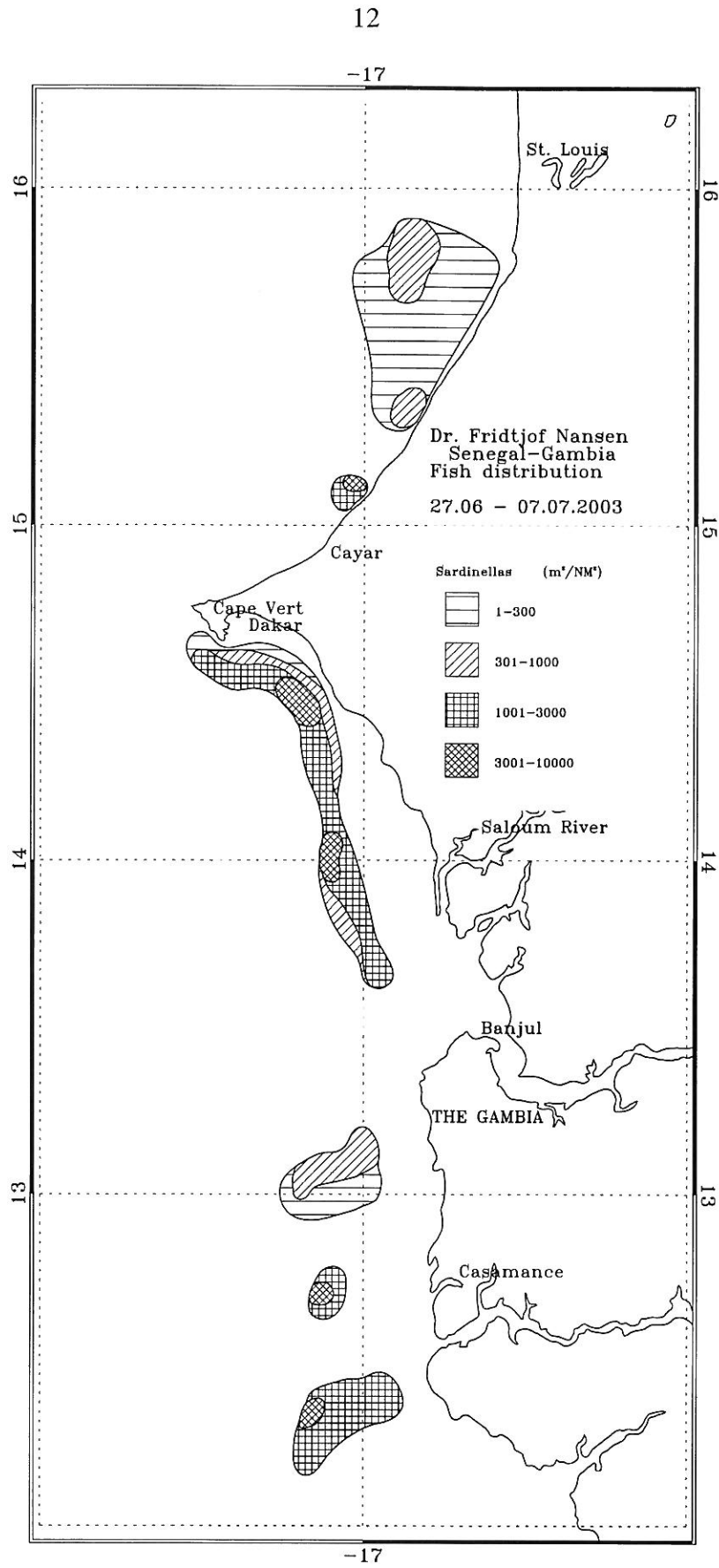


Figure 4. Distribution of sardinellas; Casamance to St. Louis.

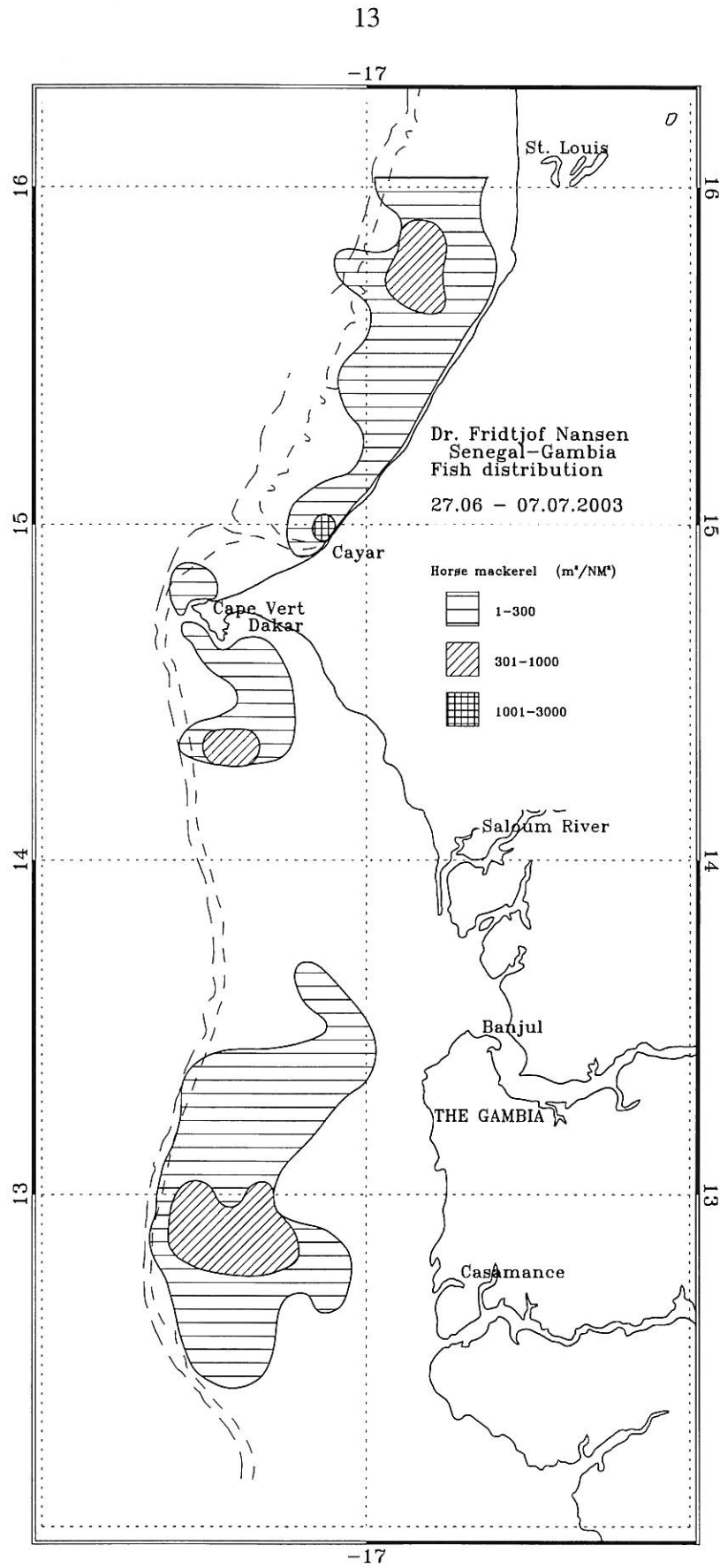


Figure 5. Horse mackerels; Casamance to St. Louis.



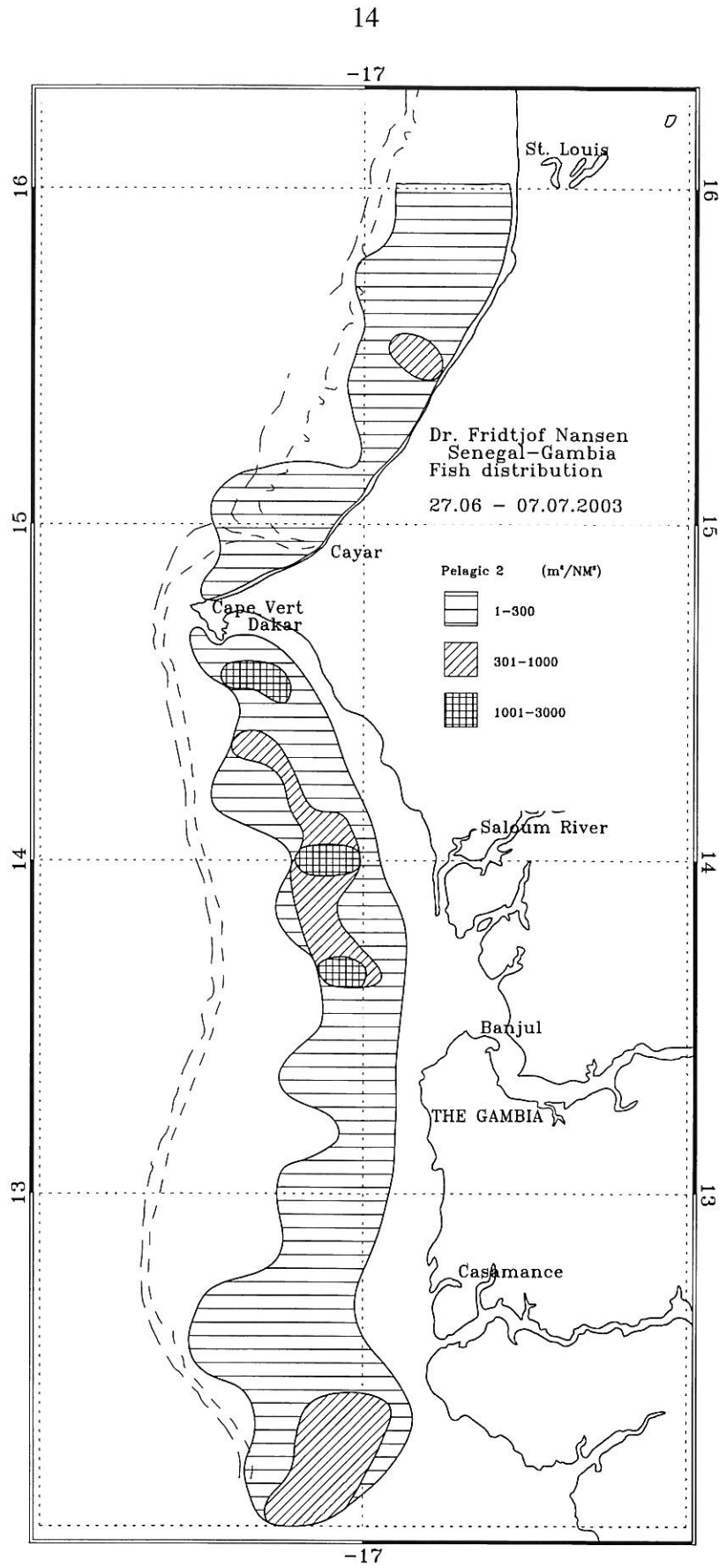


Figure 6. Carangids and associated species; Casamance to St. Louis

## 2.4 The Gambian border - Cape Vert

Sardinellas were distributed from the outlet of the Saloum River to Cape Vert (Figure 4). Medium and low densities were found in the inner parts of the shelf. Table 3 shows the biomass estimates for the two sardinella species that summed up to 340 thousand tonnes. Flat sardinella dominated the estimated biomass in the area by 96%.

Pooled length compositions of samples showed that the flat sardinella had a modal length of 22 cm while the round sardinella had a modal length of 26 cm, see Annex IV. Estimated number and biomass by length-groups are in Annex IV.

The horse mackerels in this area were distributed in the northern area, along the outer part of the shelf, Figure 5. The total biomass was estimated at 23 thousand tonnes and false scad dominated the biomass estimate by 65%. Two modal lengths of false scad were 9, 22 and 32 cm, while for Cunene horse mackerel the modal lengths were found on 8 and 19 cm.

Also here, the carangids and associated pelagic fish, were distributed over most of the area. However, in this area the concentrations were denser than in The Gambia, see Figure 6. Again, Atlantic bumper was caught in most of the trawl samples. The biomass of the carangids and associated pelagic fish was estimated at about 201 thousand tonnes, Table 3.

Table 3. The Gambia border to Cape Vert. Biomass estimates of pelagic fish, thousand tonnes.

Flat sardinella	Round sardinella	Horse mackerels	Carangids etc.
324	15	23	201

## 2.5 Cape Vert - St. Louis

The sardinellas were found in two areas of distribution, a smaller one about 10 NM north of Cayar and the other further north, see Figure 4. The round sardinella dominated the total biomass estimate of 92 thousand tonnes by 88 %. Flat sardinella had a modal length of 28 cm while round sardinella had 27 cm.

A mixture of false scad and Cunene horse mackerel were found in two medium to low density areas, one just north of Cape Vert, and the other one from Cayar northwards to the border, Figure 5. The total biomass was estimated at 67 thousand tonnes, and the catches show that

Cunene horse mackerel dominated by 67%. The modal lengths of the Cunene horse mackerel were 10 and 20 cm.

Carangids and associated pelagic fish were mainly found over the entire shelf, in a larger area, extending from Cayar to St. Louis. A smaller aggregation was found north of Cape Vert, Figure 6. The catches consisted also here of bumper, African lookdown and hairtails. The biomass estimate was 61 thousand tonnes.

Table 4. Cape Vert to St. Louis. Biomass estimates of pelagic fish, thousand tonnes.

Flat sardinella	Round sardinella	Horse mackerels	Carangids etc.
11	81	67	61

## CHAPTER 3 OVERVIEW AND SUMMARY OF RESULTS

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The survey was conducted successfully from June 27<sup>th</sup> to July 7<sup>th</sup>. A course track of approximately 1 600 NM and 34 fishing stations were established.

The hydrographical data showed a stable surface layer for the whole shelf in the south, but with declining surface temperatures towards the coast from about Cape Vert northwards.

Sardinellas were found in one main area, between Saloum River and Cape Vert, with a few smaller aggregations south and north of this, Figure 4. Flat sardinella dominated in the region south of Cape Vert, while the round sardinella dominated north of this point. The total estimate of sardinellas was 670 thousand tonnes, of which flat sardinella dominated by 86%.

Horse mackerels were found in three main areas; one between Cayar and the border to Mauritania, one south of Cape Vert, and the third from the shelf off Banjul and southwards, Figure 5. The total estimate of horse mackerels was 191 thousand tonnes of which the Cunene horse mackerel dominated by 65%.

Other carangids and associated species were distributed over most of the shelf at rather low densities, Figure 6. The catches of this group consisted of Atlantic bumper, barracudas and hairtails. The total biomass was estimated at approximately 418 thousand tonnes.

An overview of the acoustic estimates of biomass of the main groups of pelagic fish is shown in Table 5, and the geographical distribution and abundance of main species is in Figure 7. The total biomass of sardinellas was thus 670 thousand tonnes, horse mackerels 191 thousand tonnes and of carangids and associated species 418 thousand tonnes.

Table 5. Summary of biomass estimates of pelagic fish, Senegal and the Gambia. thousand tonnes.

	Flat sardinella	Round sardinella	Horse mackerels	Carangids etc.
St. Louis-Cape Vert	11	81	67	61
Cape Vert - The Gambia	324	15	23	201
The Gambia	18	-	29	15
Casamance	221	-	72	141
Total	574	96	191	418

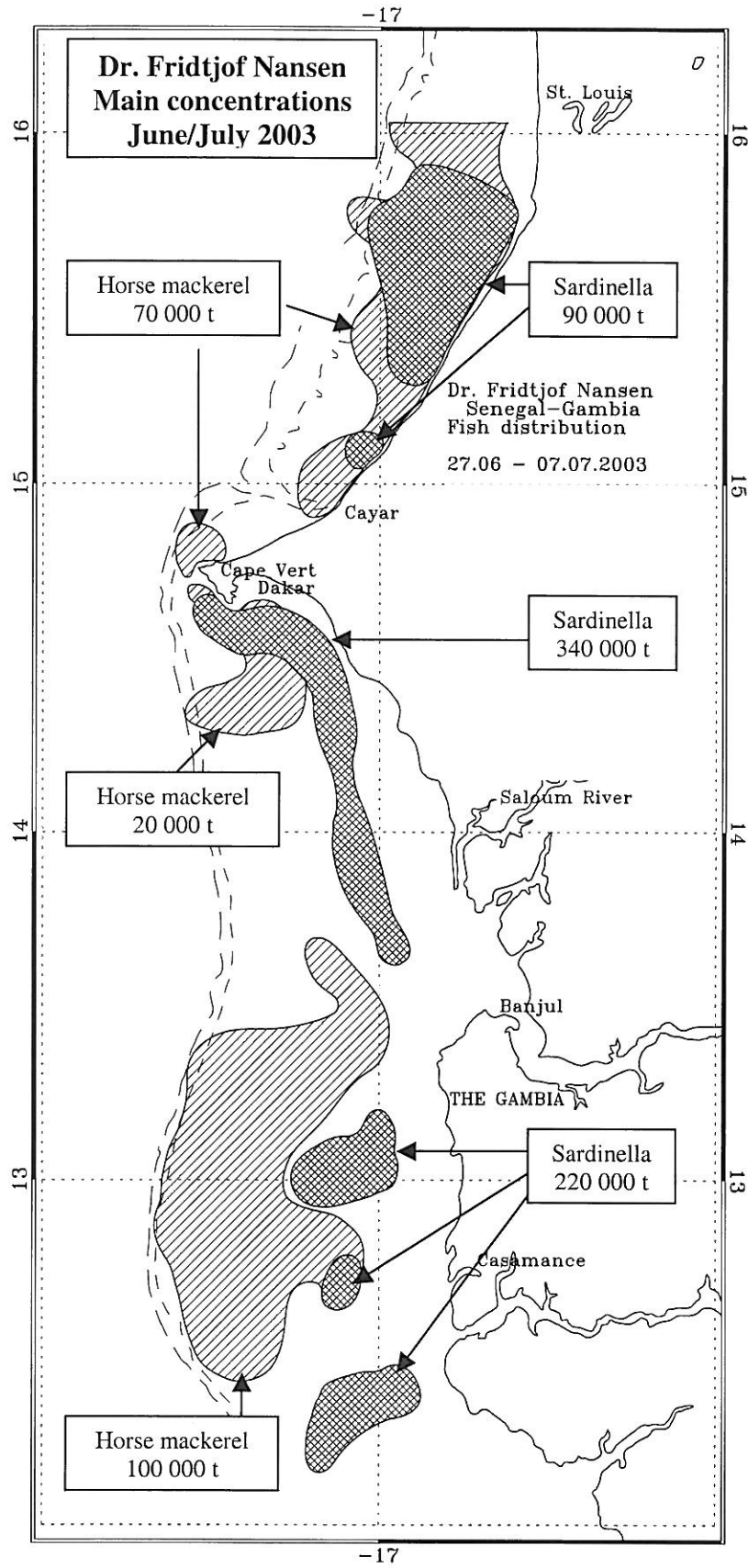


Figure 7. Major pelagic fish concentrations with estimated biomass (tonnes), Senegal and The Gambia.

Table 6 lists biomass estimates of sardinellas and carangids (including the horse mackerels) and associated species from the 'Dr. Fridtjof Nansen' surveys of this shelf region. Large-scale latitudinal movements of pelagic fish between West Sahara and Guinea Bissau are well known, and in the summer the sardinellas should be concentrated in Senegal for spawning. Compared with the July survey last year, the estimate of 670 thousand tonnes of sardinellas from the current survey is higher. The carangid estimate of 610 thousand tonnes is also higher than last years estimate.

Table 6. Biomass estimates from previous 'Dr Fridtjof Nansen' surveys of the Senegal - The Gambia shelf. Thousand tonnes.

Survey:	Sardinellas	Carangids etc.*
AprMay-81	210	570
Sept -81	360	**
FebMar-82	40	90
NovDec-86	330	170
FebMar-92	1 530	690
NovDec-95	760	220
NovDec-96	230	530
NovDec-97	300	250
NovDec-98	390	340
NovDec-99	1 390	470
NovDec-00	300	540
JunJul-01	410	230
NovDec-01	430	480
JunJul-02	600	430
NovDec-02	910	260
JunJul-03	670	610

\* Horse mackerels and other carangids

\*\* Not available

## References

Toresen, R., Gjøsæter, H., and Barros, P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research 34 (1998) 27-37.

## RESUME

La campagne a été conduite avec succès durant la période du 30 juin au 8 juillet selon un parcours d'une longueur approximative de 1600 milles nautiques. Au total, 34 stations de pêche de contrôle ont été réalisées.

Les données hydrographiques révèlent une stabilité de la température des eaux de surface pour la zone sud, de la Casamance à Cap Vert tandis qu'au Nord on assiste à une diminution de celles ci vers la côte.

Les sardinelles ont été rencontrées principalement dans la zone s'étendant du fleuve Saloum jusqu'à Cap Vert, avec quelques autres concentrations de moindre taille au nord et au sud (voir figure 4). Les sardinelles plates ont été prédominantes dans la zone sud tandis les sardinelles rondes sont majoritaires à partir de Cap Vert vers St. Louis. La biomasse totale des sardinelles est estimée à 670 milles tonnes, dont 86% de sardinelles plates.

Les chinchards ont été rencontrés essentiellement dans trois zones : la première entre Cayar et la frontière nord, la seconde au sud de Cap Vert et la troisième à partir de Banjul vers le sud (cf. figure 5). La biomasse totale des chinchards est évaluée à 191 milles tonnes où le chinchard noir domine à 65%.

Les autres carangidés et espèces associées sont régulièrement distribués sur toute la côte avec de moindres densités (cf. figure 6). Les espèces principalement capturées ont été le plat-plat, *Chloroscombrus chrysurus*, le barracuda, *Sphyræna guachancho* et la ceinture, *Trichurus lepturus*. La biomasse totale est estimée à 418 milles tonnes.

Le tableau 5 ci-dessous résume la biomasse pour chaque groupe de pélagiques ; la répartition géographique et l'abondance de ces espèces sont présentées en figure 7. Ainsi, la biomasse totale des sardinelles s'élève à 670 milles tonnes, celles de chinchards à 126 milles tonnes et les carangidés et espèces associées sont estimées à 418 milles tonnes.

Tableau 5. Résumé des biomasses de pélagiques au Sénégal et en Gambie(en milliers de tonnes).

	Sardinelles plates	Sardinelles rondes	Chinchards	Carangidés etc.
St. Louis – Cap Vert	11	81	67	61
Cap Vert – Gambie	324	15	23	201
Gambie	18	-	29	15
Casamance	221	-	72	141
Total	574	96	191	418

Le tableau 6 récapitule les biomasses totales estimées depuis 1981 par le N/O Dr. Fridtjof Nansen; il s'agit de l'ensemble des sardinelles, chinchards, carangidés et associées sur les cotes sénégalaises.

Il est maintenant bien connu de l'existence dans la sous région de flux migratoires à grande échelle de poissons pélagiques entre le Sahara de l'Ouest et la Guinée Bissau, et le repli des sardinelles vers le Sénégal en période chaude pour assurer la reproduction. La biomasse de 670 milles tonnes de sardinelles estimées cette campagne est supérieure à celle trouvée l'année à la même période. Le même constat est valable pour les carangidés et associés estimés à 610 miles tonnes.

Tableau 6. Récapitulatif des biomasses estimées par le N/O Dr. Fridtjof Nansen sur les cotes sénégalaises.

Campagne	Sardinelles	Carangidés etc.*
Avril-mai 81	210	570
Sept 81	360	**
Février-mars 82	40	90
Nov-décembre 86	330	170
Fevrier-mars 92	1 530	690
Nov-decembre 95	760	220
Nov-decembre 96	230	530
Nov-decembre 97	300	250
Nov-decembre 98	390	340
Nov-decembre 99	1 390	470
Nov-decembre 00	300	540
Juin-juillet 01	410	230
Nov-decembre 01	430	480
Juin-juillet 02	600	430
Nov-decembre 02	910	260
Juin-juillet 03	670	610

\* Chinchards et autres carangidés

\*\* non disponibles.



# Annex I Records of fishing stations

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2001  
 DATE:28/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1557  
 start stop duration Long W 1645  
 TIME :16:32:24 17:02:36 30 (min) Purpose code: 1  
 LOG :9548.98 9550.64 1.65 Area code : 4  
 FDEPTH: 69 69 GearCond.code:  
 BDEPTH: 69 69 Validity code:  
 Towing dir: 20° Wire out: 250 m Speed: 31 kn\*10  
 Sorted: 54 Kg Total catch: 128.48 CATCH/HOUR: 256.96

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	71.50	540	27.83	
Trachurus trecae	44.25	640	17.22	3368
Decapterus rhonchus	44.25	180	17.22	3367
Alectis alexandrinus	18.96	70	7.38	
Pagellus bellottii	14.20	110	5.53	
Pseudolithus senegalensis	11.76	34	4.58	
Raja miraletus	9.80	24	3.81	
Selene dorsalis	6.56	4	2.55	
Citharus linguatula	4.60	150	1.79	
Pomatomus saltatrix	4.40	4	1.71	
Brotula barbata	4.36	34	1.70	
Trachurus trecae, juvenile	2.90	430	1.13	
GOBIIDAE	2.90	3550	1.13	
G A S T R O P O D S	2.70	274	1.05	
Campogramma glycos	2.58	4	1.00	
Trichurus lepturus	2.50	10	0.97	
Sphyræna guachancho	2.10	10	0.82	
Priacanthus arenatus	1.70	4	0.66	
Selar crumenophthalmus	1.50	4	0.58	
Loligo vulgaris	0.90	370	0.35	
Serranus africana	0.86	10	0.33	
Zeus faber	0.80	24	0.31	
Cynoponticus ferox	0.34	2	0.13	
Chelidonichthys gabonensis	0.20	10	0.08	
Sardina pilchardus	0.14	30	0.05	
Sardinella aurita	0.10	4	0.04	
Spherooides spengleri	0.10	10	0.04	
Solea hexophtalma *	0.06	4	0.02	
Total	257.04		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2002  
 DATE:28/ 6/03 GEAR TYPE: PT No: 6 POSITION:Lat N 1547  
 start stop duration Long W 1643  
 TIME :22:04:47 22:34:15 29 (min) Purpose code: 1  
 LOG :9598.19 9600.09 1.91 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 41 41 Validity code:  
 Towing dir: 16° Wire out: 135 m Speed: 39 kn\*10  
 Sorted: 96 Kg Total catch: 180.40 CATCH/HOUR: 373.24

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Decapterus rhonchus	181.74	1415	48.69	
Sardinella aurita	77.90	252	20.87	3369
Mobula sp.	51.72	2	13.86	
Sardinella maderensis	20.38	106	5.46	3370
Selene dorsalis	12.91	112	3.46	
Alectis alexandrinus	8.63	6	2.31	
Chloroscombrus chrysurus	6.33	37	1.70	
Engraulis encrasicolus	5.83	1291	1.56	
Galeoides decadactylus	3.10	8	0.83	
Trachurus trecae	2.36	310	0.63	
Trichurus lepturus	1.49	37	0.40	
Trachinotus ovatus	0.46	2	0.12	
Sphyræna guachancho	0.39	2	0.10	
Total	373.24		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2003  
 DATE:29/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1526  
 start stop duration Long W 1651  
 TIME :08:02:04 08:34:23 32 (min) Purpose code: 1  
 LOG :9691.01 9693.32 2.31 Area code : 4  
 FDEPTH: 10 24 GearCond.code:  
 BDEPTH: 40 39 Validity code:  
 Towing dir: 20° Wire out: 90 m Speed: 42 kn\*10  
 Sorted: 32 Kg Total catch: 129.32 CATCH/HOUR: 242.48

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	187.88	1485	77.48	
Pomadasyd jubelini	13.80	30	5.69	
Sphyræna guachancho	9.45	23	3.90	
Trachinotus ovatus	9.38	30	3.87	
Selene dorsalis	5.25	60	2.17	
Campogramma glycos	4.20	8	1.73	
Brachydeuterus auritus	3.98	30	1.64	
Sardinella maderensis	3.90	15	1.61	
Decapterus rhonchus	3.75	15	1.55	
Ilisha africana	0.90	8	0.37	
Total	242.49		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2004  
 DATE:29/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1522  
 start stop duration Long W 1657  
 TIME :11:01:39 11:19:43 18 (min) Purpose code: 1  
 LOG :9714.11 9715.06 0.94 Area code : 4  
 FDEPTH: 75 76 GearCond.code:  
 BDEPTH: 75 76 Validity code:  
 Towing dir: 360° Wire out: 230 m Speed: 32 kn\*10  
 Sorted: 40 Kg Total catch: 39.54 CATCH/HOUR: 131.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Decapterus rhonchus	37.33	100	28.32	3372
Octopus vulgaris	14.87	10	11.28	
Dentex angolensis	14.40	163	10.93	
Alectis alexandrinus	12.47	7	9.46	
Trachurus trecae	10.10	980	7.66	
C R U S T A C E A N S	10.07	3357	7.64	3371
Loligo vulgaris	9.63	327	7.31	
Citharus linguatula	7.63	237	5.79	
Raja miraletus	3.20	7	2.43	
Brachydeuterus auritus	2.83	17	2.15	
Gobioidea sp	2.20	183	1.67	
Priacanthus arenatus	1.40	3	1.06	
Pagellus bellottii	1.37	3	1.04	
Zeus faber	1.27	20	0.96	
G A S T R O P O D S	1.13	240	0.86	
Pterothrissus belloci	0.83	13	0.63	
Chelidonichthys gabonensis	0.83	13	0.63	
Selene dorsalis	0.70	47	0.53	
Pontinus kuhlii	0.07	7	0.05	
Parapenaeus longirostris	0.07	20	0.05	
Brotula barbata	0.07	3	0.05	
Spherooides spengleri	0.03	3	0.02	
Squilla mantis	0.03	3	0.02	
Boops boops	0.03	3	0.02	
Total	132.56		100.56	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2005  
 DATE:29/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1517  
 start stop duration Long W 1708  
 TIME :15:45:18 16:15:38 30 (min) Purpose code: 1  
 LOG :9757.46 9759.03 1.55 Area code : 4  
 FDEPTH: 141 134 GearCond.code:  
 BDEPTH: 141 134 Validity code:  
 Towing dir: 34° Wire out: 390 m Speed: 32 kn\*10  
 Sorted: Kg Total catch: 176.75 CATCH/HOUR: 353.50

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Synagrops microlepis	223.00	67500	63.08	
Trichurus lepturus	100.70	238	28.49	
Pterothrissus belloci	7.40	380	2.09	
Loligo vulgaris	7.30	100	2.07	
Merluccius merluccius	4.50	260	1.27	
Raja miraletus	2.88	4	0.81	
Octopus vulgaris	2.40	4	0.68	
Scorpaena stephanica	1.50	60	0.42	
Citharus linguatula	1.00	20	0.28	
Chlorophthalmus atlanticus	0.80	140	0.23	
Zeus faber	0.70	2	0.20	
Syacium micrurum	0.52	10	0.15	
Capros aper	0.40	30	0.11	
Chelidonichthys gabonensis	0.30	10	0.08	
GOBIIDAE	0.10	10	0.03	
Total	353.50		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2006  
 DATE:29/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1511  
 start stop duration Long W 1659  
 TIME :18:03:05 18:20:27 17 (min) Purpose code: 1  
 LOG :9774.44 9775.35 0.91 Area code : 4  
 FDEPTH: 50 49 GearCond.code:  
 BDEPTH: 50 49 Validity code:  
 Towing dir: 36° Wire out: 200 m Speed: 31 kn\*10  
 Sorted: 60 Kg Total catch: 1139.02 CATCH/HOUR: 4020.07

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	2678.82	17456	66.64	
Trachurus trecae	458.82	6565	11.41	
Pagellus bellottii	406.59	2682	10.11	
Pomadasyd incisus	199.06	1129	4.95	
Selene dorsalis	152.47	1129	3.79	
Pseudupeneus prayensis	69.88	565	1.74	
Sparus caeruleostictus *	44.47	141	1.11	
Octopus vulgaris	6.28	7	0.16	
Mustelus mustelus	3.67	4	0.09	
Total	4020.06		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2007  
 DATE:29/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1505  
 start stop duration Long W 1703  
 TIME :20:03:41 20:24:53 21 (min) Purpose code: 1  
 LOG :9789.57 9791.08 1.46 Area code : 4  
 FDEPTH: 25 30 GearCond.code: 4  
 BDEPTH: 49 44 Validity code:  
 Towing dir: 300 Wire out: 90 m Speed: 43 kn\*10  
 Sorted: 69 Kg Total catch: 1176.08 CATCH/HOUR: 3360.23

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Brachydeuterus auritus	1954.29	12971	58.16
Sardinella aurita	960.00	4171	28.57
Selene dorsalis	195.43	1543	5.82
Trachurus trecae	174.86	1029	5.20
Sardinella maderensis	25.71	114	0.77
Decapterus rhonchus	13.71	57	0.41
Sphyræna guachancho	12.51	23	0.37
Alectis alexandrinus	8.50	26	0.26
Boops boops	5.71	57	0.17
Pomadasy jubelini	5.00	11	0.15
Pomadasy rogeri	4.40	3	0.13
Total	3360.22	100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2008  
 DATE:30/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1458  
 start stop duration Long W 1709  
 TIME :01:40:19 01:40:46 34 (min) Purpose code: 1  
 LOG :9847.94 9849.68 1.97 Area code : 4  
 FDEPTH: 64 71 GearCond.code: 2  
 BDEPTH: 64 71 Validity code: 2  
 Towing dir: 100 Wire out: 200 m Speed: 32 kn\*10  
 Sorted: 29 Kg Total catch: 449.62 CATCH/HOUR: 793.45

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae	350.74	3785	44.20
Chelidonichthys gabonensis	288.53	1032	36.36
Dentex angolensis	45.53	1641	5.74
Pseudupeneus prayensis	29.91	291	3.77
Scorpaena stephanica	26.47	503	3.34
Torpedo torpedo	11.65	26	1.47
Microchirus variegatus	11.12	53	1.40
Lagocephalus lagocephalus	8.47	26	1.07
Solea senegalensis	6.35	53	0.80
Cynoglossus monodi	3.97	26	0.50
Sycium micrurum	2.91	265	0.37
Loligo vulgaris	1.85	26	0.23
Octopus vulgaris	1.45	2	0.18
Boops boops	1.32	26	0.17
Spherooides spengleri	1.06	450	0.13
Trachinus draco	0.79	26	0.10
Chilomycterus spinosus mauret.	0.53	53	0.07
Sardina pilchardus	0.53	53	0.07
Sardinella maderensis	0.26	53	0.03
Total	793.44	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2009  
 DATE:30/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1449  
 start stop duration Long W 1733  
 TIME :14:15:56 14:45:37 30 (min) Purpose code: 1  
 LOG :9918.31 9919.96 1.62 Area code : 4  
 FDEPTH: 124 127 GearCond.code:  
 BDEPTH: 124 127 Validity code:  
 Towing dir: 450 Wire out: 390 m Speed: 32 kn\*10  
 Sorted: 27 Kg Total catch: 186.62 CATCH/HOUR: 373.24

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae	317.80	4298	85.15
Trachurus trecae, juvenile	28.28	3038	7.58
Raja miraletus	11.20	14	3.00
Capros aper	10.78	140	2.89
Decapterus rhonchus	3.36	14	0.90
Loligo vulgaris	1.54	42	0.41
Synagrops microlepis	0.28	28	0.08
Total	373.24	100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2010  
 DATE:30/ 6/03 GEAR TYPE: PT No: 6 POSITION:Lat N 1441  
 start stop duration Long W 1731  
 TIME :21:50:46 22:13:21 23 (min) Purpose code: 1  
 LOG :9989.00 9990.41 1.38 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 43 46 Validity code:  
 Towing dir: 3300 Wire out: 125 m Speed: 38 kn\*10  
 Sorted: 63 Kg Total catch: 189.91 CATCH/HOUR: 495.42

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella maderensis	171.52	730	34.62
Trachurus trecae, juvenile	105.13	848	21.22
Sphyræna guachancho	45.91	157	9.27
Decapterus rhonchus	44.22	417	8.93
Sardina pilchardus	42.78	3052	8.64
Pomadasy peroteti	17.48	13	3.53
Selar crumenophthalmus	13.96	52	2.82
Mustelus mustelus	13.46	5	2.72
Engraulis encrasicolus	9.78	1787	1.97
Sardinella aurita	8.35	39	1.69
Acanthurus monroviae	8.22	13	1.66
Alectis alexandrinus	4.96	8	1.00
Boops boops	4.30	170	0.87
Mugil sp.	3.00	13	0.61
Chloroscombrus chrysurus	2.35	13	0.47
Total	495.42	100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2011  
 DATE: 1/ 7/03 GEAR TYPE: PT No: 5 POSITION:Lat N 1432  
 start stop duration Long W 1718  
 TIME :04:28:02 04:55:57 28 (min) Purpose code: 1  
 LOG : 50.50 52.30 1.80 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 39 36 Validity code:  
 Towing dir: 3600 Wire out: 120 m Speed: 41 kn\*10  
 Sorted: 61 Kg Total catch: 1076.00 CATCH/HOUR: 2305.71

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella maderensis	1140.00	15300	49.44
Chloroscombrus chrysurus	855.00	17814	37.08
Sardina pilchardus	127.89	8814	5.55
Brachydeuterus auritus	76.24	600	3.31
Sphyræna guachancho	40.14	111	1.74
Decapterus rhonchus	19.89	75	0.86
Trachurus trecae	16.50	1689	0.72
Pomadasy incisus	13.89	75	0.60
Sardinella aurita	12.75	450	0.55
Pomadasy jubelini	1.11	4	0.05
Total	2303.41	99.90	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2012  
 DATE: 1/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1430  
 start stop duration Long W 1710  
 TIME :06:36:45 06:48:29 12 (min) Purpose code: 1  
 LOG : 66.19 66.88 0.65 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 24 25 Validity code:  
 Towing dir: 2970 Wire out: 135 m Speed: 38 kn\*10  
 Sorted: 38 Kg Total catch: 189.15 CATCH/HOUR: 945.75

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella maderensis	750.00	6325	79.30
Selene dorsalis	57.75	50	6.11
Scomber japonicus	46.75	100	4.94
Engraulis encrasicolus	27.00	625	2.85
Chloroscombrus chrysurus	26.00	100	2.75
Sardinella aurita	25.50	150	2.70
Sardina pilchardus	5.25	950	0.56
Sphyræna guachancho	3.75	325	0.40
Sardinella maderensis - Juv.	3.75	325	0.40
Total	945.75	100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2013  
 DATE: 1/ 7/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1420  
 start stop duration Long W 1709  
 TIME :08:39:36 09:19:16 40 (min) Purpose code: 1  
 LOG : 82.77 85.00 2.22 Area code : 4  
 FDEPTH: 24 30 GearCond.code:  
 BDEPTH: 24 30 Validity code:  
 Towing dir: 3100 Wire out: 120 m Speed: 35 kn\*10  
 Sorted: 33 Kg Total catch: 480.90 CATCH/HOUR: 721.35

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Chloroscombrus chrysurus	258.75	5310	35.87
Pomadasy incisus	92.48	720	12.82
Plectorhynchus mediterraneus	92.25	293	12.79
Pseudupeneus prayensis	66.15	1080	9.17
Pagellus acarne	57.83	585	8.02
Decapterus rhonchus	50.85	1395	7.05
Pagellus bellottii	27.90	428	3.87
Galoides decadactylus	23.40	180	3.24
Boops boops	17.55	5130	2.43
Trachurus trecae	16.65	2025	2.31
Dentex canariensis	7.43	23	1.03
SCARIDAE	4.28	45	0.59
Sardinella maderensis	3.38	23	0.47
Octopus vulgaris	2.48	2	0.34
Total	721.38	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2014  
 DATE: 1/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1410  
 start stop duration Long W 1708  
 TIME :17:45:25 18:08:52 23 (min) Purpose code: 1  
 LOG : 166.70 168.15 1.44 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 25 25 Validity code:  
 Towing dir: 2700 Wire out: 120 m Speed: 35 kn\*10  
 Sorted: Kg Total catch: 250.00 CATCH/HOUR: 652.17

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Dermochelys coriacea coriacea	652.17	3	100.00
Total	652.17	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2015  
 DATE: 1/ 7/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1410 Long W 1704  
 start stop duration  
 TIME :19:46:47 20:11:03 24 (min) Purpose code: 1  
 LOG : 175.53 176.90 1.35 Area code : 4  
 FDEPTH: 18 21 GearCond.code:  
 BDEPTH: 18 21 Validity code:  
 Towing dir: 270° Wire out: 120 m Speed: 34 kn\*10

Sorted: 28 Kg Total catch: 688.25 CATCH/HOUR: 1720.63

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	675.00	6625	39.23	
Pomadasys jubelini	262.50	750	15.26	
Sardinella maderensis	144.38	750	8.39	
Decapterus rhonchus	140.00	875	8.14	
Sparus caeruleostictus *	133.13	1125	7.74	
Galeoides decadactylus	98.75	875	5.74	
Sphyræna guachancho	48.13	125	2.80	
Aluterus blankerti	41.25	250	2.40	
Pagellus bellottii	39.38	438	2.29	
Sepia officinalis hierredda	35.00	63	2.03	
Diplodus bellottii	18.13	250	1.05	
Eucinostomus melanopterus	15.63	125	0.91	
Pseudupeneus prayensis	11.88	125	0.69	
Plectrohinchus mediterraneus	10.00	125	0.58	
Spondyliosoma cantharus	4.38	63	0.25	
Boops boops	3.75	125	0.22	
Total	1681.29		97.72	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2016  
 DATE: 1/ 7/03 GEAR TYPE: PT No: 6 POSITION:Lat N 1406 Long W 1709  
 start stop duration  
 TIME :21:40:32 21:40:59 (min) Purpose code: 1  
 LOG : 187.84 187.86 0.01 Area code : 4  
 FDEPTH: 5 5 GearCond.code:  
 BDEPTH: 31 31 Validity code:  
 Towing dir: 145° Wire out: 130 m Speed:450 kn\*10

Sorted: 22 Kg Total catch: 44.52 CATCH/HOUR: 2671.20

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	2493.00	38400	93.33	
Sphyræna guachancho	67.20	120	2.52	
Aluterus blankerti	56.40	600	2.11	
Decapterus rhonchus	25.20	600	0.94	
Trachurus trecae	15.60	2400	0.58	
Peneaus kerathurus	9.60	120	0.36	
Boops boops	4.80	120	0.18	
Parapenaeus longirostris	2.40	120	0.09	
Total	2674.20		100.11	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2017  
 DATE: 1/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1406 Long W 1709  
 start stop duration  
 TIME :22:43:17 22:56:36 13 (min) Purpose code: 1  
 LOG : 191.06 191.91 0.84 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 31 31 Validity code:  
 Towing dir: 149° Wire out: 125 m Speed: 35 kn\*10

Sorted: 14 Kg Total catch: 142.60 CATCH/HOUR: 658.15

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	533.08	8446	81.00	
Sphyræna guachancho	45.69	92	6.94	
Eucinostomus melanopterus	40.62	462	6.17	
Decapterus rhonchus	33.69	462	5.12	
Trachurus trecae	3.23	185	0.49	
Sardinella maderensis	1.85	46	0.28	
Total	658.16		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2018  
 DATE: 2/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1402 Long W 1704  
 start stop duration  
 TIME :00:12:57 00:36:43 24 (min) Purpose code: 1  
 LOG : 200.83 202.36 1.51 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 24 27 Validity code:  
 Towing dir: 305° Wire out: 120 m Speed: 41 kn\*10

Sorted: 60 Kg Total catch: 487.36 CATCH/HOUR: 1218.40

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	496.00	6980	40.71	3389
Chloroscombrus chrysurus	342.10	8820	28.08	
Sardinella aurita	230.00	1320	18.88	3388
Decapterus rhonchus	73.00	720	5.99	3390
Eucinostomus melanopterus	49.60	760	4.07	
Sphyræna guachancho	10.00	40	0.82	
Arius heudeloti	10.00	20	0.82	
Brachydeuterus auritus	3.00	20	0.25	
Engraulis encrasicolus	2.80	300	0.23	
Peneaus notialis	1.60	60	0.13	
Trachurus trecae	0.40	40	0.03	
Total	1218.50		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2019  
 DATE: 2/ 7/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1349 Long W 1725  
 start stop duration  
 TIME :06:02:00 06:08:53 7 (min) Purpose code: 1  
 LOG : 254.96 255.33 0.36 Area code : 4  
 FDEPTH: 94 96 GearCond.code:  
 BDEPTH: 94 96 Validity code:  
 Towing dir: 350° Wire out: 300 m Speed: 31 kn\*10

Sorted: 31 Kg Total catch: 1377.90 CATCH/HOUR: 11810.57

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	6865.71	87171	58.13	3391
Boops boops	3012.43	35871	25.51	
Dentex macropthalmus	1083.86	6943	9.18	
Dentex congogensis	855.43	6943	7.24	
Total	11817.43		100.06	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2020  
 DATE: 2/ 7/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1350 Long W 1700  
 start stop duration  
 TIME :09:16:03 09:18:41 3 (min) Purpose code: 1  
 LOG : 283.66 283.83 0.18 Area code : 4  
 FDEPTH: 19 19 GearCond.code:  
 BDEPTH: 19 19 Validity code:  
 Towing dir: 360° Wire out: 120 m Speed: 35 kn\*10

Sorted: 29 Kg Total catch: 83.19 CATCH/HOUR: 1663.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	887.40	19460	53.34	
Sardinella maderensis	374.00	2700	22.48	3392
Plectrohinchus mediterraneus	245.00	40	14.73	
Arius heudeloti	43.60	40	2.62	
Brachydeuterus auritus	41.60	440	2.50	
Sparus caeruleostictus *	22.00	100	1.32	
Scarus hoefleri	20.60	100	1.24	
Decapterus rhonchus	16.60	40	1.00	
Octopus vulgaris	8.00	40	0.48	
Pseudupeneus prayensis	5.00	40	0.30	
Total	1663.80		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2021  
 DATE: 2/ 7/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1344 Long W 1702  
 start stop duration  
 TIME :10:53:53 11:23:01 29 (min) Purpose code: 1  
 LOG : 293.89 295.57 1.67 Area code : 4  
 FDEPTH: 26 29 GearCond.code:  
 BDEPTH: 26 29 Validity code:  
 Towing dir: 310° Wire out: 120 m Speed: 33 kn\*10

Sorted: 57 Kg Total catch: 369.02 CATCH/HOUR: 763.49

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	536.65	5729	70.29	
Pomadasys jubelini	84.06	445	11.01	
Pseudupeneus prayensis	50.03	377	6.55	
Pomadasys peroteti	41.01	95	5.37	
Sparus caeruleostictus *	22.86	108	2.99	
Decapterus rhonchus	6.60	68	0.86	
Priacanthus arenatus	5.23	14	0.69	
Pomadasys incisus	3.91	27	0.51	
Alectis alexandrinus	3.64	14	0.48	
Scarus hoefleri	3.23	14	0.42	
Eucinostomus melanopterus	3.23	27	0.42	
Pagellus bellottii	2.42	14	0.32	
Total	762.87		99.91	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2022  
 DATE: 2/ 7/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1339 Long W 1656  
 start stop duration  
 TIME :12:45:45 13:19:34 34 (min) Purpose code: 1  
 LOG : 307.33 309.01 1.70 Area code : 4  
 FDEPTH: 18 18 GearCond.code:  
 BDEPTH: 18 18 Validity code:  
 Towing dir: 360° Wire out: 120 m Speed: 30 kn\*10

Sorted: 45 Kg Total catch: 45.30 CATCH/HOUR: 79.94

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sphyræna afra	29.03	2	36.31	
Sepia officinalis hierredda	8.38	25	10.48	
Chloroscombrus chrysurus	7.29	71	9.12	
Scomberomorus tritor	6.48	7	8.11	
Caranx hippos	5.12	5	6.40	
Octopus vulgaris	3.74	12	4.68	
Alectis alexandrinus	3.67	9	4.59	
Arius heudeloti	3.48	9	4.35	
Pomadasys jubelini	2.26	4	2.83	
Raja undulata	1.54	4	1.93	
Remora remora	1.43	2	1.79	
Decapterus rhonchus	1.39	41	1.74	
Lagocephalus lagocephalus	1.39	4	1.74	
Dasyatis marmorata	1.11	5	1.39	
Epinephelus aeneus	0.92	2	1.15	
Scarus hoefleri	0.74	5	0.93	
Eucinostomus melanopterus	0.55	4	0.69	
Mugil cephalus	0.53	2	0.66	
Synaptura lusitanica	0.53	4	0.66	
Brachydeuterus auritus	0.37	4	0.46	
Total	79.95		100.01	



DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2031  
 DATE: 4/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1230  
 start stop duration Long W 1711  
 TIME :17:41:38 18:13:02 31 (min) Purpose code: 1  
 LOG : 742.48 744.71 2.21 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 18 19 Validity code:  
 Towing dir: 270° Wire out: 100 m Speed: 35 kn\*10  
 Sorted: 26 Kg Total catch: 184.85 CATCH/HOUR: 357.77

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	350.61	7939	98.00	
Sphyræna guachancho	6.29	12	1.76	
Sardinella maderensis	0.52	4	0.15	
Brachydeuterus auritus	0.35	4	0.10	
Total	357.77		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2032  
 DATE: 4/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1223  
 start stop duration Long W 1656  
 TIME :20:42:06 21:12:11 30 (min) Purpose code: 1  
 LOG : 765.38 767.26 1.77 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 19 19 Validity code:  
 Towing dir: 312° Wire out: 152 m Speed: 38 kn\*10  
 Sorted: 36 Kg Total catch: 334.95 CATCH/HOUR: 669.90

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	296.00	4600	44.19	
Chloroscombrus chrysurus	152.00	3720	22.69	
Arius heudeloti	86.00	1320	12.84	
Arius laticutatus	26.60	40	3.97	
Pteroscion peli	23.80	500	3.55	
Sardinella maderensis	21.00	160	3.13	
Rhizoprionodon acutus	18.00	40	2.69	
Trichiurus lepturus	13.20	460	1.97	
Ilisha africana	10.00	420	1.49	
Galeoides decadactylus	8.40	60	1.25	
Sphyræna guachancho	7.00	12	1.04	
Parapenaeus longirostris	6.20	1780	0.93	
Pomadourus peroteti	0.90	2	0.13	
Selene dorsalis	0.80	20	0.12	
Total	669.90		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2033  
 DATE: 4/ 7/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1220  
 start stop duration Long W 1702  
 TIME :23:29:41 23:36:24 7 (min) Purpose code: 1  
 LOG : 784.79 785.27 0.47 Area code : 4  
 FDEPTH: 0 0 GearCond.code:  
 BDEPTH: 27 27 Validity code:  
 Towing dir: 90° Wire out: 125 m Speed: 40 kn\*10  
 Sorted: 54 Kg Total catch: 4000.00 CATCH/HOUR: 34285.72

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	26346.52	240737	76.84	3400
Chloroscombrus chrysurus	6722.66	175431	19.61	
Brachydeuterus auritus	819.51	9600	2.39	
Sardinella aurita	313.71	2563	0.91	
Ilisha africana	83.23	1277	0.24	
Total	34285.63		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2034  
 DATE: 5/ 7/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1204  
 start stop duration Long W 1709  
 TIME :07:01:19 07:14:57 14 (min) Purpose code: 1  
 LOG : 854.28 855.22 0.93 Area code : 4  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 39 38 Validity code:  
 Towing dir: 360° Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 23 Kg Total catch: 215.45 CATCH/HOUR: 923.36

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	578.57	9000	62.66	
Arius heudeloti	151.07	69	16.36	
Rhizoprionodon acutus	124.29	39	13.46	
Sardinella maderensis	19.93	146	2.16	3401
Sphyræna guachancho	16.71	253	1.81	
Scomberomorus tritor	7.80	103	0.84	
Echeneis naucrates	7.46	47	0.81	
Selene dorsalis	6.73	9	0.73	
Caranx senegalus	6.26	4	0.68	
Decapterus rhonchus	1.54	4	0.17	
Selar crumenophthalmus	1.46	4	0.16	
Albula vulpes	1.33	4	0.14	
Total	923.15		99.98	

## Annex II Instruments and fishing gear used

The Simrad EK-500, 38kHz echo scientific sounder was used during the survey for fish abundance estimation. The Bergen Echo Integrator system (BEI) logging the echogram raw data from the sounder, was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape, and a backup of the database of scrutinized data, stored. The details of the settings of the 38kHz were as follows:

<b>Transceiver-1 menu</b>	Transducer depth	5.5 m
	Absorption coeff.	10 dB/km
	Pulse length	medium (1ms)
	Bandwidth	wide
	Max power	2000 Watt
	2-way beam angle	-21.0 dB
	SV transducer gain	27.01 dB
	TS transducer gain	27.14 dB
	Angle sensitivity	21.9
	3 dB beamwidth along.	6.8°
	3 dB beamwidth athw.	6.8°
	Alongship offset	-0.05°
	Athwardship offset	0.09°
<b>Display menu</b>	Echogram	1
	Bottom range	10 m
	Bottom range start	9 m
	TVG	20 log R
	Sv colour min	-67 dB
	TS Colour minimum	-60 dB
<b>Printer- menu</b>	Range	0-50, 0-100, 0-150, 0-250 or 0-500m
	TVG	20 log R
	Sv colour min	-60 dB
<b>Bottom detection menu</b>	Minimum level	-40 dB

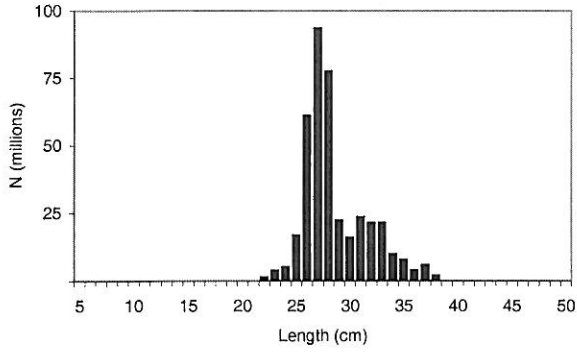
A calibration experiment using a standard copper sphere was performed in Langstrand, Namibia on 22 April 2003.

### Fishing gear

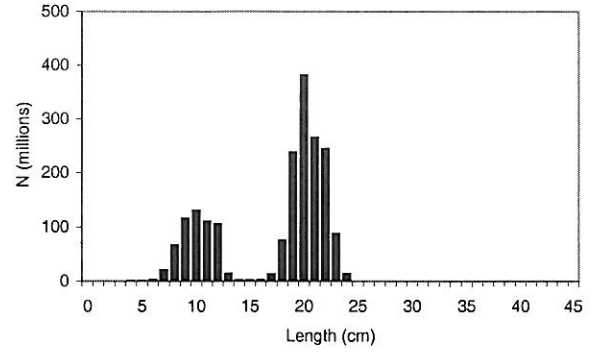
The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super" bottom trawl. For all trawls, the Tyborøn, 7.8m<sup>2</sup> (1670 kg) trawl doors were used.

## Annex III Pooled length distributions by species

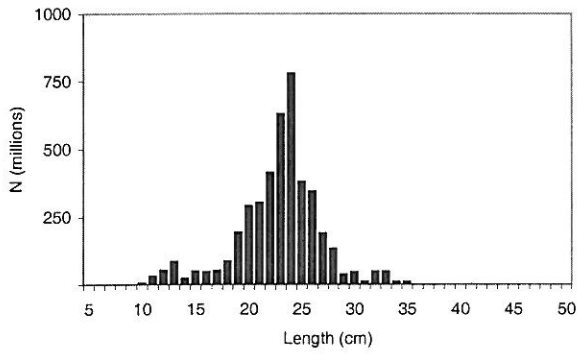
*Sardinella aurita*, Casamance-Cape Vert



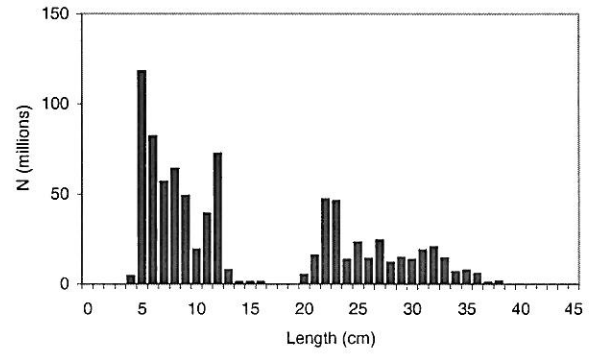
*Trachurus trecae*, Cape Vert-St. Louis



*Sardinella maderensis*, Casam.-Cape Vert



*Caranx rhonchus*, Casamance-Cape Vert



## Annex IV Estimates of numbers and weight by length.

### Senegal and The Gambia, June-July 2003

#### *Sardinella aurita*

Length cm	N (thousands)					Biomass (tonnes)				
	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22		1 285			1 285		140			140
23		3 854			3 854		480			480
24		5 139			5 139		726			726
25		16 703			16 703		2 659			2 659
26	35 353	25 697			61 050	6 316	4 591			10 907
27	72 934	20 557			93 491	14 561	4 104			18 666
28	65 971	11 563			77 535	14 661	2 570			17 231
29	22 267				22 267	5 488				5 488
30	15 863				15 863	4 321				4 321
31	23 376				23 376	7 014				7 014
32	21 428				21 428	7 061				7 061
33	21 428				21 428	7 734				7 734
34	9 740				9 740	3 840				3 840
35	7 792				7 792	3 347				3 347
36	3 896				3 896	1 819				1 819
37	5 844				5 844	2 958				2 958
38	1 948				1 948	1 067				1 067
39	1 948					1 153				1 153
40										
TOTAL	309 787	84 799			392 637	81 339	15 270			96 608



## Annex IV continued

### Senegal and The Gambia, June-July 2003

#### *Sardinella maderensis*

Length cm	N (thousands)					Biomass (tonnes)				
	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL
5										
6										
7										
8										
9										
10		5 275			5 275		59			59
11		31 652			31 652		462			462
12		52 754			52 754		989			989
13		84 926			84 926		2 006			2 006
14		22 142			22 142		648			648
15		49 560			49 560		1 772			1 772
16		33 213	989	11 995	46 197		1 432	43	517	1 992
17		45 325	494	5 998	51 817		2 332	25	309	2 666
18		66 178	1 483	17 993	85 654		4 023	90	1 094	5 206
19		186 327	494	5 998	192 819		13 263	35	427	13 725
20		243 889	3 575	43 368	290 832		20 171	296	3 587	24 053
21		238 441	4 906	59 515	302 862		22 749	468	5 678	28 896
22		333 638	6 044	73 329	413 011		36 483	661	8 018	45 163
23		290 788	25 767	312 610	629 166		36 229	3 210	38 947	78 386
24	7 712	290 361	36 643	444 557	779 272	1 089	40 993	5 173	62 762	110 017
25	8 814	130 963	18 284	221 826	379 887	1 403	20 847	2 910	35 311	60 471
26	9 915	123 497	16 027	194 442	343 882	1 771	22 063	2 863	34 738	61 435
27	8 814	57 129	9 319	113 059	188 321	1 760	11 406	1 861	22 572	37 598
28	11 017	104 737	1 266	15 354	132 373	2 448	23 276	281	3 412	29 418
29	6 610	19 043	844	10 236	36 733	1 629	4 693	208	2 523	9 053
30	2 203	38 086	422	5 118	45 829	600	10 374	115	1 394	12 483
31	1 102	9 522			10 623	331	2 857			3 188
32		47 608			47 608		15 689			15 689
33		47 608			47 608		17 182			17 182
34		9 522			9 522		3 753			3 753
35		9 522			9 522		4 089			4 089
36		9 522			9 522		4 445			4 445
37										
38										
39										
40										
<b>TOTAL</b>	<b>56 187</b>	<b>2 581 225</b>	<b>126 556</b>	<b>1 535 398</b>	<b>4 299 366</b>	<b>11 031</b>	<b>324 285</b>	<b>18 240</b>	<b>221 289</b>	<b>574 845</b>

## Annex IV continued

### Senegal and The Gambia, June-July 2003

*Trachurus trecae*

Length cm	N (thousands)					Biomass (tonnes)				
	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL
4		883			883		1			1
5		442			442		1			1
6		2 458			2 458		6			6
7	4 366	16 121			20 487	18	65			83
8	21 419	42 196	2 601		66 215	126	249	15		390
9	75 201	38 624	1 300		115 125	619	318	11		948
10	95 788	30 291	3 901		129 981	1 065	337	43		1 445
11	85 264	3 772	20 806		109 842	1 245	55	304		1 604
12	21 686	11 891	71 522		105 099	407	223	1 341		1 971
13	4 160	1 691	7 802		13 653	98	40	184		322
14		208	1 300		1 509		6	38		44
15		208	1 300		1 509		7	46		54
16		900	1 300		2 201		39	56		95
17	8 435	4 152			12 587	434	214			648
18	25 700	22 910		26 762	75 372	1 562	1 393		1 627	4 581
19	74 745	39 749		123 040	237 534	5 321	2 829		8 758	16 908
20	139 345	15 298		227 150	381 793	11 525	1 265		18 786	31 576
21	118 549	3 051		143 927	265 527	11 311	291		13 732	25 333
22	74 976	2 034		167 425	244 435	8 199	222		18 308	26 729
23	22 280			65 110	87 389	2 776			8 112	10 888
24	3 713			9 301	13 015	524			1 313	1 837
25										
26										
TOTAL	775 627	236 878	111 834	762 714	1 887 054	45 228	7 561	2 039	70 636	125 464

## Annex IV continued

### Senegal and The Gambia, June-July 2003

#### *Caranx rhonchus*

Length cm	N (thousands)					Biomass (tonnes)				
	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL	St. Louis- Cape Vert	Cape Vert Gambia	The Gambia	Casa- mance	TOTAL
3										
4				4 540	4 540				4	4
5				118 039	118 039				189	189
6		442		81 719	82 161		1		215	217
7		2 306		54 480	56 786		9		221	230
8		2 306	2 601	59 020	63 927		14		348	362
9		6 820	1 300	40 860	48 981		56		336	392
10		6 281	3 901	9 080	19 262		70		101	171
11		4 858	20 806	13 620	39 284		71		199	270
12		883	71 522		72 405		17			17
13			7 802		7 802					
14			1 300		1 300					
15			1 300		1 300					
16			1 300		1 300					
17										
18										
19										
20		5 205			5 205		431			431
21		16 005			16 005		1 527			1 527
22	3 216	40 199	3 728		47 143	352	4 396	408		5 155
23	1 608	22 348	22 367		46 323	200	2 784	2 787		5 771
24	1 608	4 588	7 456		13 651	227	648	1 053		1 927
25	1 608	6 611	14 911		23 130	256	1 052	2 374		3 682
26	6 433	3 938	3 728		14 098	1 149	703	666		2 519
27	19 298	1 335	3 728		24 361	3 853	267	744		4 864
28	11 257	738			11 995	2 502	164			2 666
29	9 649	1 335	3 728		14 712	2 378	329	919		3 626
30	4 890	1 193	7 456		13 539	1 332	325	2 031		3 688
31	5 791	1 790	11 183		18 765	1 738	537	3 356		5 631
32	3 347	2 387	14 911		20 645	1 103	787	4 914		6 803
33	5 856	1 193	7 456		14 505	2 114	431	2 691		5 235
34	2 510	597	3 728		6 834	989	235	1 470		2 694
35	3 347	597	3 728		7 671	1 437	256	1 601		3 295
36	1 673	597	3 728		5 998	781	279	1 740		2 800
37	837				837	424				424
38	1 673				1 673	917				917
39										
40										
TOTAL	84 602	134 552	223 668	381 357	824 179	21 751	15 388	26 751	1 613	65 503

## Annex V Regional estimates, May-July 2003

Sardine (*Sardina pilchardus*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6		4.8					4.8
7	162.2	84.8					247.0
8	1 731.9	394.0	11.4	220.7			2 358.1
9	1 694.8	1 048.5	295.5	6 377.5			9 416.3
10	208.1	1 105.2	848.3	8 255.1			10 416.6
11	7.9	3 638.6	2 133.0	3 876.2			9 655.6
12	35.6	5 541.1	3 226.4	531.0			9 334.0
13	336.0	3 969.2	1 391.8				5 697.1
14	1 709.6	1 880.8	983.4				4 573.7
15	5 896.3	291.4	1 132.9				7 320.7
16	8 222.0	46.8	414.6				8 683.4
17	3 754.7	418.4					4 173.1
18	1 493.6	2 098.9					3 592.5
19	1 334.4	2 877.7					4 212.1
20	450.6	12 510.9	25.5				12 987.0
21	59.1	16 102.0	93.3				16 254.4
22		11 533.1	129.9	38.6			11 701.6
23	68.9	8 714.6	318.1	38.6			9 140.3
24	84.3	6 013.1	647.4	77.2			6 821.9
25	7.7	2 048.6	722.7	386.0			3 164.9
26		473.5	218.4	193.0			884.9
27		36.1	29.1	308.8			374.0
28		3.2		77.2			80.4
29		1.5					1.5
30							
Total	27 257.5	80 836.9	12 621.7	20 379.8			141 096.0

Sardine (*Sardina pilchardus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6		11					11
7	561	293					855
8	8 722	1 984	58	1 111			11 875
9	11 915	7 372	2 077	44 837			66 201
10	1 975	10 491	8 052	78 362			98 880
11	99	45 377	26 601	48 340			120 417
12	570	88 743	51 673	8 504			149 490
13	6 778	80 080	28 081				114 939
14	42 737	47 017	24 583				114 337
15	180 050	8 899	34 594				223 543
16	302 859	1 725	15 273				319 857
17	165 006	18 388					183 394
18	77 545	108 974					186 519
19	81 136	174 970					256 106
20	31 830	883 823	1 800				917 453
21	4 815	1 312 230	7 603				1 324 648
22		1 077 228	12 136	3 605			1 092 969
23	7 336	927 400	33 853	4 108			972 696
24	10 160	725 117	78 067	9 309			822 654
25	1 041	278 543	98 263	52 481			430 329
26		72 251	33 335	29 450			135 036
27		6 153	4 967	52 659			63 779
28		603		14 654			15 256
29		310					310
30							
Total	935 135	5 877 983	461 016	347 420			7 621 555

## Annex V continued

Round sardinella (*Sardinella aurita*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11			225.3				225.3
12			1 305.2	12.5			1 317.7
13			2 409.3	8.3			2 417.6
14			864.1	4.2			868.3
15			765.2	4.2			769.4
16			211.0				211.0
17			82.2				82.2
18			8.9				8.9
19							
20							
21							
22						1.3	1.3
23		4.2		1.2		3.9	9.2
24		28.6		4.6		5.1	38.3
25		157.5		3.5		16.7	177.7
26		345.4		20.1	35.4	25.7	426.5
27		323.3		21.0	72.9	20.6	437.8
28		262.4		74.7	66.0	11.6	414.6
29		173.0		187.5	22.3		382.7
30		206.1		236.0	15.9		457.9
31		13.3		244.1	23.4		280.8
32		45.5		198.3	21.4		265.2
33		69.2		244.1	21.4		334.7
34		81.4		106.3	9.7		197.4
35		100.8		37.4	7.8		146.0
36		57.0		17.1	3.9		78.1
37		37.9		5.3	5.8		49.0
38		11.8		2.6	1.9		16.4
39		21.6			1.9		23.6
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		1 938.9	5 871.3	1 432.9	309.8	84.8	9 637.8

## Annex V continued

Round sardinella (*Sardinella aurita*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11			3 289				3 289
12			24 473	234			24 708
13			56 907	197			57 103
14			25 289	122			25 411
15			27 355	149			27 504
16			9 097				9 097
17			4 232				4 232
18			544				544
19							
20							
21							
22						140	140
23		514		144		480	1 138
24		3 952		651		726	5 328
25		24 552		550		2 659	27 761
26		60 416		3 593	6 316	4 591	74 915
27		63 202		4 187	14 561	4 104	86 055
28		57 090		16 599	14 661	2 570	90 920
29		41 740		46 214	5 488		93 441
30		54 964		64 278	4 321		123 563
31		3 910		73 248	7 014		84 172
32		14 682		65 345	7 061		87 088
33		24 453		88 102	7 734		120 288
34		31 408		41 904	3 840		77 152
35		42 391		16 084	3 347		61 821
36		26 077		8 002	1 819		35 898
37		18 791		2 674	2 958		24 424
38		6 336		1 447	1 067		8 850
39		12 516			1 153		13 669
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		486 993	151 186	433 723	81 339	15 270	1 168 511

## Annex V continued

Flat sardinella (*Sardinella maderensis*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10						5.3	5.3
11			77.0			31.7	108.6
12			615.8			52.8	668.6
13			446.5			84.9	531.4
14			354.1			22.1	376.2
15			184.7			49.6	234.3
16			182.9			46.2	229.1
17			529.6			51.8	581.4
18			820.9			85.7	906.5
19			211.8	1.2		192.8	405.8
20			132.4	3.6		290.8	426.8
21			158.9	5.9		302.9	467.7
22			317.8	19.0		413.0	749.8
23			185.4	16.6		629.2	831.2
24			79.4	18.1	7.7	771.6	876.8
25				17.7	8.8	371.1	397.6
26				49.7	9.9	334.0	393.5
27		4.9		51.1	8.8	179.5	244.4
28		14.8		53.5	11.0	121.4	200.7
29		52.3		35.3	6.6	30.1	124.3
30		124.5		20.9	2.2	43.6	191.2
31		131.7		5.3	1.1	9.5	147.6
32		140.7		13.2		47.6	201.5
33		130.0		5.3		47.6	182.9
34		119.9		5.3		9.5	134.7
35		51.0				9.5	60.5
36		2.4				9.5	11.9
37							
38							
39							
40		0.2					0.2
41		0.2					0.2
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		772.7	4 297.2	321.6	56.2	4 243.2	9 690.9

## Annex V continued

Flat sardinella (*Sardinella maderensis*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10						59	59
11			1 124			462	1 586
12			11 546			989	12 536
13			10 545			2 006	12 551
14			10 363			648	11 011
15			6 604			1 772	8 376
16			7 887			1 992	9 880
17			27 248			2 666	29 914
18			49 897			5 206	55 103
19			15 080	85		13 725	28 890
20			10 950	295		24 053	35 298
21			15 159	567		28 896	44 621
22			34 747	2 080		45 163	81 990
23			23 094	2 073		78 386	103 553
24			11 215	2 554	1 089	108 928	123 786
25				2 817	1 403	59 068	63 288
26				8 871	1 771	59 664	70 307
27		998		10 204	1 760	35 839	48 801
28		3 334		11 887	2 448	26 969	44 638
29		13 034		8 691	1 629	7 424	30 778
30		34 273		5 684	600	11 883	52 439
31		39 928		1 585	331	2 857	44 700
32		46 854		4 352		15 689	66 896
33		47 419		1 907		17 182	66 508
34		47 766		2 083		3 753	53 602
35		22 125				4 089	26 215
36		1 142				4 445	5 587
37							
38							
39							
40		102					102
41		109					109
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		257 084	235 460	65 733	11 031	563 814	1 133 123



## Annex V continued

Anchovy (*Engraulis encrasicolus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5	124.7						124.7
6	407.3	1.6					408.9
7	333.9	46.2		95.8			475.9
8	354.1	101.3		583.4			1 038.8
9	258.8	44.1		1 486.6			1 789.4
10	206.8	16.0	11.8	2 350.9			2 585.5
11	401.5	2.2	1 054.5	4 225.3			5 683.4
12	880.6	1.7	2 000.5	5 062.1			7 945.0
13	1 190.9	0.4	506.7	1 313.3			3 011.3
14	523.7	0.4	63.4	87.4			675.0
15	95.3						95.3
16	5.0						5.0
17							
18							
19							
20							
Total	4 782.6	213.9	3 636.9	15 204.8			23 838.2

Anchovy (*Engraulis encrasicolus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5	112						112
6	604	2					606
7	761	105		218			1 084
8	1 174	336		1 935			3 445
9	1 198	204		6 883			8 285
10	1 293	100	74	14 696			16 162
11	3 297	18	8 660	34 701			46 676
12	9 288	18	21 099	53 390			83 795
13	15 822	6	6 731	17 449			40 008
14	8 621	7	1 044	1 439			11 111
15	1 916						1 916
16	122						122
17							
18							
19							
20							
Total	44 208	796	37 609	130 709			213 323

## Annex V continued

Atlantic horse mackerel (*Trachurus trachurus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7			2.2				2.2
8	22.7		34.6				57.3
9	79.4		123.4				202.8
10	17.0		1 240.8				1 257.9
11		2.9	444.8				447.8
12	1.1	5.9	30.0				37.1
13		19.1	10.0				29.1
14		29.9					29.9
15		136.1					136.1
16		293.7					293.7
17		502.2					502.2
18		1 018.6					1 018.6
19		1 078.3					1 078.3
20		607.8					607.8
21		144.4					144.4
22		38.0					38.0
23		14.8					14.8
24		7.8					7.8
25		45.6					45.6
26		72.4					72.4
27		72.3					72.3
28		36.7					36.7
29		38.5					38.5
30		29.8					29.8
31		31.4					31.4
32		27.9					27.9
33	1.7	22.7					24.4
34							
35	3.8						3.8
36	2.1						2.1
37	1.7						1.7
38	5.4						5.4
39	2.7						2.7
40	24.9						24.9
41	4.9						4.9
42	9.0						9.0
43	12.3						12.3
44	1.8						1.8
45							
46							
47							
48							
49							
50							
Total	190.5	4 277.0	1 885.8				6 353.3

## Annex V continued

Atlantic horse mackerel (*Trachurus trachurus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7				9			9
8	117		204				321
9	572		1 015				1 587
10	166		13 790				13 955
11		38	6 495				6 532
12	19	97	563				678
13		395	236				632
14		764					764
15		4 256					4 256
16		11 083					11 083
17		22 609					22 609
18		54 177					54 177
19		67 165					67 165
20		43 985					43 985
21		12 052					12 052
22		3 635					3 635
23		1 617					1 617
24		961					961
25		6 354					6 354
26		11 315					11 315
27		12 636					12 636
28		7 146					7 146
29		8 311					8 311
30		7 101					7 101
31		8 255					8 255
32		8 043					8 043
33	544	7 167					7 710
34							
35	1 428						1 428
36	849						849
37	762						762
38	2 578						2 578
39	1 373						1 373
40	13 885						13 885
41	2 970						2 970
42	5 779						5 779
43	8 478						8 478
44	1 325						1 325
45							
46							
47							
48							
49							
50							
Total	40 845	299 163	22 312				362 320

## Annex V continued

Cunene horse mackerel (*Trachurus trecae*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						0.9	0.9
5						0.4	0.4
6				171.5		2.5	174.0
7				693.2	4.4	16.1	713.7
8				541.2	21.4	44.8	607.5
9				2 484.6	75.2	39.9	2 599.8
10		17.9		4 692.2	95.8	34.2	4 840.1
11		170.2	18.2	1 667.4	85.3	24.6	1 965.6
12		454.1	118.5	465.8	21.7	83.4	1 143.5
13		1 603.5	1 026.6	328.7	4.2	9.5	2 972.5
14		1 889.7	1 462.9	2 071.8		1.5	5 425.9
15		1 458.3	1 610.8	1 628.4		1.5	4 699.0
16		620.9	744.4	601.9		2.2	1 969.5
17		242.7	321.6	115.3	8.4	4.2	692.3
18		57.6	86.6	67.5	25.7	49.7	287.1
19		11.5		67.5	74.7	162.8	316.5
20		19.1			139.3	242.4	400.9
21		3.1			118.5	147.0	268.6
22					75.0	169.5	244.4
23		8.0			22.3	65.1	95.4
24		24.2			3.7	9.3	37.2
25		61.3					61.3
26		60.3					60.3
27		36.0					36.0
28		7.9					7.9
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		6 746.4	5 389.6	15 597.3	775.6	1 111.4	29 620.3

## Annex V continued

Cunene horse mackerel (*Trachurus trecae*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						1	1
5						1	1
6				452		6	459
7				2 808	18	65	2 891
8				3 191	126	264	3 581
9				20 450	619	329	21 398
10		174		52 145	1 065	380	53 764
11		2 174	266	24 345	1 245	359	28 389
12		7 450	2 222	8 733	407	1 564	20 376
13		33 141	24 247	7 765	98	224	65 475
14		48 391	42 813	60 636		44	151 884
15		45 617	57 584	58 214		54	161 469
16		23 430	32 104	25 957		95	81 585
17		10 926	16 548	5 934	434	214	34 055
18		3 065	5 265	4 104	1 562	3 019	17 015
19		716		4 806	5 321	11 588	22 431
20		1 384			11 525	20 052	32 960
21		255			11 311	14 023	25 588
22					8 199	18 530	26 729
23		876			2 776	8 112	11 764
24		2 994			524	1 313	4 831
25		8 539					8 539
26		9 424					9 424
27		6 285					6 285
28		1 545					1 545
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		206 385	181 048	279 541	45 228	80 237	792 438

## Annex V continued

False scad (*Caranx rhonchus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						4.5	4.5
5						118.0	118.0
6						82.2	82.2
7						56.8	56.8
8						63.9	63.9
9						49.0	49.0
10						19.3	19.3
11						39.3	39.3
12						72.4	72.4
13						7.8	7.8
14						1.3	1.3
15						1.3	1.3
16						1.3	1.3
17							
18							
19							
20						5.2	5.2
21						16.0	16.0
22					3.2	43.9	47.1
23					1.6	44.7	46.3
24					1.6	12.0	13.7
25					1.6	21.5	23.1
26					6.4	7.7	14.1
27					19.3	5.1	24.4
28					11.3	0.7	12.0
29					9.6	5.1	14.7
30					4.9	8.6	13.5
31					5.8	13.0	18.8
32					3.3	17.3	20.6
33					5.9	8.6	14.5
34					2.5	4.3	6.8
35					3.3	4.3	7.7
36					1.7	4.3	6.0
37					0.8		0.8
38					1.7		1.7
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total					84.6	739.6	824.2

## Annex V continued

False scad (*Caranx rhonchus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						4	4
5						189	189
6						217	217
7						230	230
8						362	362
9						392	392
10						171	171
11						270	270
12						17	17
13							
14							
15							
16							
17							
18							
19							
20						431	431
21						1 527	1 527
22					352	4 803	5 155
23					200	5 571	5 771
24					227	1 700	1 927
25					256	3 426	3 682
26					1 149	1 369	2 519
27					3 853	1 011	4 864
28					2 502	164	2 666
29					2 378	1 248	3 626
30					1 332	2 356	3 688
31					1 738	3 893	5 631
32					1 103	5 701	6 803
33					2 114	3 122	5 235
34					989	1 705	2 694
35					1 437	1 857	3 295
36					781	2 019	2 800
37					424		424
38					917		917
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total					21 751	43 752	65 503

## Annex V continued

Chub mackerel (*Scomber japonicus*), numbers in millions

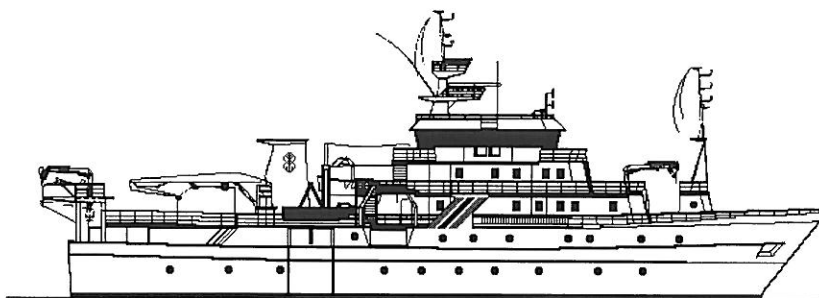
Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11		63.2					63.2
12		11.0					11.0
13	42.0	15.3					57.4
14	497.1	101.6					598.7
15	231.0	216.7					447.8
16	21.0	223.6					244.6
17	0.8	97.7					98.5
18		44.3					44.3
19		32.8					32.8
20	5.9	54.1					60.0
21	16.8	91.3					108.1
22	29.2	123.9					153.0
23	61.0	165.0					226.0
24	43.8	182.2					226.0
25	5.1	109.0					114.2
26	14.5	103.4					117.8
27	4.9	180.5					185.4
28		277.2					277.2
29	1.0	147.6					148.5
30	0.5	117.2					117.6
31	11.8	47.9					59.7
32	13.9	38.6					52.5
33	9.9	28.8					38.7
34	2.0	11.0					13.0
35	4.0	9.7					13.7
36		1.8					1.8
37		6.9					6.9
38							
39		2.7					2.7
40		0.1					0.1
41		3.3					3.3
42		3.2					3.2
43		0.1					0.1
44		0.3					0.3
45		0.3					0.3
46		0.3					0.3
47		0.2					0.2
48		0.1					0.1
49		0.1					0.1
50		0.1					0.1
Total	1 016.0	2 513.1					3 529.1



## Annex V continued

Chub mackerel (*Scomber japonicus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11		807					807
12		181					181
13	868	317					1 185
14	12 729	2 603					15 332
15	7 227	6 780					14 007
16	793	8 436					9 229
17	36	4 400					4 436
18		2 357					2 357
19		2 041					2 041
20	427	3 915					4 342
21	1 402	7 622					9 024
22	2 789	11 851					14 640
23	6 651	17 990					24 641
24	5 405	22 512					27 917
25	716	15 185					15 902
26	2 263	16 159					18 422
27	851	31 534					32 385
28		53 903					53 903
29	207	31 825					32 032
30	114	27 925					28 039
31	3 110	12 564					15 674
32	4 000	11 132					15 132
33	3 115	9 100					12 215
34	684	3 788					4 471
35	1 489	3 660					5 149
36		754					754
37		3 078					3 078
38							
39		1 385					1 385
40		32					32
41		1 979					1 979
42		2 055					2 055
43		40					40
44		213					213
45		273					273
46		243					243
47		207					207
48		55					55
49		117					117
50		62					62
Total	54 877	319 079					373 956



**SURVEY OF THE PELAGIC FISH RESOURCES  
OFF NORTH WEST AFRICA**

**Part II**

**MAURITANIA**

**17 - 27 June 2003**

CRUISE REPORTS 'DR FRIDTJOF NANSEN'

**SURVEY OF THE PELAGIC FISH RESOURCES  
NORTH WEST AFRICA**

**Part II**

**MAURITANIA  
17 - 27 June 2003**

by

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Bergen, 2003**

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## CHAPTER 1 INTRODUCTION

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### 1.1 Objective of the cruise

The general objectives were to estimate the biomass and map the distribution of small pelagic fish stocks off NW Africa (Morocco, Mauritania, Senegal and The Gambia) by hydro-acoustic methods and describe the hydrographic conditions there over a period of 50 days, in May-July 2003. For Mauritania the agreed objectives were:

- To map the distribution and estimate the biomass of the main small pelagic fish using hydro-acoustic methods. The species of interest are: sardine *Sardina pilchardus*, sardinella *Sardinella aurita* and *S. maderensis*, horse mackerels *Trachurus trachurus* and *T. trecae*, false scad *Caranx rhonchus*, anchovy *Engraulis encrasicolus* and chub mackerel *Scomber japonicus*.
- To identify and describe the size distribution of the target fish populations by mid-water and bottom trawl sampling and process the catches by recording weight and number by species.
- To collect otoliths of sardine and sardinella for later reading ashore.
- To sample standard hydrographical transects for temperature, salinity and oxygen at about 16°40'N, 18°00'N, 19°00'N, 20°00'N and off Cape Blanc.

The time allocated for this part of the survey, off Mauritania, was 10 days.

### 1.2 Participation

Members of the scientific teams were:

Institut Mauritanien de Recherches Océanographiques et des Pêches:

Diallo IBRA, Wagué ABDOULAYE, Cheikh Baye Ould ISSELMOU, Saikou Oumar KIDE, Mohammed Ahmed Ould TALEB

Centre de Recherches Océanographiques de Dakar-Thiaroye, Senegal:  
Abdoulaye SARRE, Mor SYLLA

Department of Fisheries, The Gambia:  
Juldah JALLOW

Institut National de Recherche Halieutique, Morocco:  
Mostafa CHBANI

Institute of Marine Research, Norway:  
Reidar TORESEN, Magne OLSEN, Tore MØRK and Terje HOVLAND

### **1.3 Narrative**

After embarking of scientists from Mauritania, Senegal and The Gambia in Nouakchott the survey of the Mauritanian shelf started on June the 17, at Cape Blanc, with systematic parallel course tracks spaced about 10 NM (nautical miles) apart. To cover the whole distribution area of pelagic fish, the shelf was covered from the 15 m isobath and offshore to the 500 m isobath. Trawling was done irregularly, either to identify echo registrations or to check 'blindly' if fish were mixed with the plankton in the upper layers of the water column. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). The shelf was covered south to St. Louis before a call was made in Nouakchott on June 27, to let participants from Morocco and Mauritania disembark, and scientists from Senegal and The Gambia come onboard.

The hydrographic profile at 16°40'N was sampled on 24 June, at 18°00'N on 22 at 19°00'N on 21, and at 20°00'N on 19. The profile off Cape Blanc was sampled on the Morocco coverage.

The survey was terminated in Nouakchott on 26 June. The course tracks with the fishing and hydrographical stations are shown in Figure 1.

### **1.4 Methods**

#### *Environmental data*

Surface temperature and meteorological data from a weather station were logged automatically and recorded with position and bottom depth every nautical mile sailed.

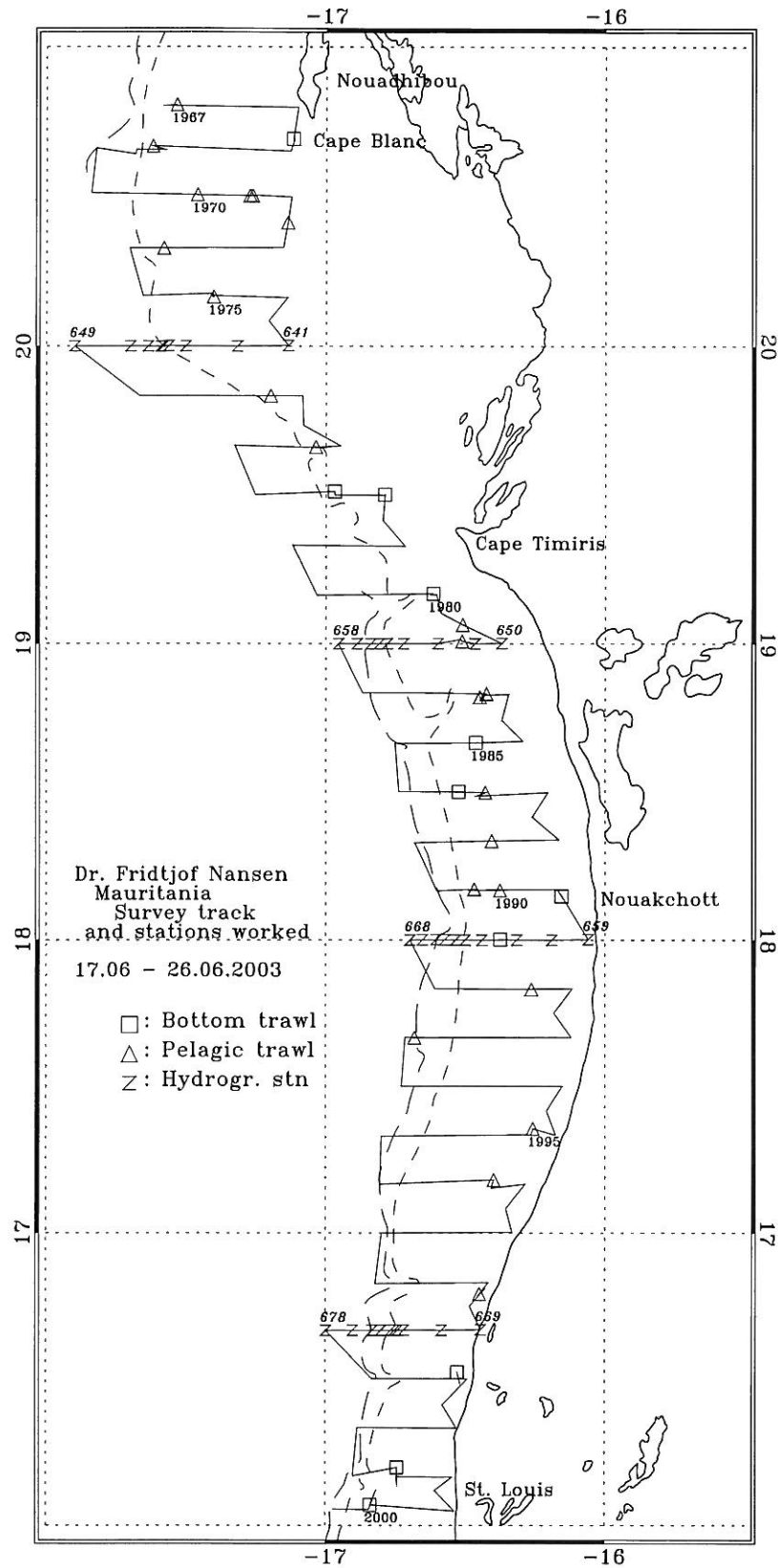


Figure 1. Course track and fishing and hydrographic stations.

Hydrographic profiles were collected with a Seabird 911+ CTD probe. Temperature, salinity, oxygen and pressure (depth) were logged by the Seabird Software. From these data series, records were selected from standard depths and presented in figures.

### *Biological sampling*

Biological sampling of the fish was carried out using trawls. A pelagic trawl with floats was often used. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). Annex II gives a description of the instruments and the fishing gear used. All catches were sampled for composition by weight and numbers of each species caught. Species identification was based on the FAO Species Guides. Length frequency distributions, by total fish length in cm, of the selected target species were taken in all the stations where they were present. Individual weight measurements were taken regularly to estimate the condition factor in the length-weight relationship:

$$\bar{w} = \frac{cond}{100} \cdot L^3$$

The specific condition factors obtained from the samples and applied for this survey were: 0.96 for sardinellas and horse mackerels, 0.82 for pilchard and 0.54 for anchovy. For chub mackerel, *Scomber japonicus*, a condition factor of 0.84 was used.

For the estimation of the biomass of carangids and associated species, an overall average length of 23 cm and a condition factor of 0.88 (to calculate the mean length of this length group) were applied.

All data on fishing stations and fish length sampling were made available to the participants on diskettes.

The complete records of fishing stations are shown in Annex I.

The following target groups were used for Mauritania:

1. Sardinellas (flat sardinella *Sardinella maderensis* and round sardinella *S. aurita*),
2. Sardine *Sardina pilchardus*,
3. Horse mackerels (Atlantic horse mackerel *Trachurus trachurus*, Cunene horse mackerel *Trachurus trecae*, and false scad *Caranx rhonchus*),
4. Anchovy *Engraulis encrasicolus*,
5. Chub mackerel *Scomber japonicus*,



6. Other pelagic carangids and associated species (Atlantic bumper *Chloroscombrus chrysurus*, African lookdown *Selene dorsalis*, largehead hairtail *Trichiurus lepturus* and barracudas *Sphyraena* spp.),
7. Other demersal species (such as bigeye grunt *Brachydeuterus auritus*, Sparidae and Haemulidae),
8. Other clupeids such as West African ilisha *Ilisha africana*.

#### *Acoustic sampling*

A SIMRAD EK500 Echo-sounder was used with the settings as shown in Annex II. The Bergen Integrator (BEI) was used for analysis and allocation of the integrated  $s_A$ -values to the individual specified target groups by 5 NM intervals. The allocation of values to target groups was based on a combination of a visual scrutiny of the behaviour pattern as deduced from echo diagrams, the BEI analysis, and the catch compositions.

In cases where the target category of fish contains more than one species (sardinellas and horse mackerels), the mean  $s_A$ -value allocated to the category is divided between the species in the same ratio as their contribution to the mean back scattering strength in the length frequency samples.

The following target strength (TS) function was applied to convert  $s_A$ -values (mean integrator value for a given species or group of species in a specified area) to number of fish:

$$TS = 20 \log L - 72 \text{ dB}$$

Which can be converted (see Toresen *et al.* 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26 \cdot 10^6 \cdot L^{-2}$$

where  $L$  is total length in 1 cm length group  $i$  and  $C_{Fi}$  ( $\text{m}^{-2}$ ) is the reciprocal back scattering strength, or so-called fish conversion factor.

In order to split and convert the allocated  $s_A$ -values ( $\text{m}^2/\text{NM}^2$ ) to fish densities (numbers per length group per  $\text{NM}^2$ ), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^n \frac{p_i}{C_{Fi}}}$$

where

$\rho_i$  = density of fish in length group  $i$

$s_A$  = mean integrator value

$p_i$  = proportion of fish in length group  $i$

$\sum_{i=1}^n \frac{p_i}{C_{Fi}}$  = the relative back scattering cross section ( $m^2$ ) of the length frequency

sample of the target species, and

$C_{fi}$  = reciprocal back scattering cross section ( $\sigma_{bs}^{-1}$ ) of a fish in length group  $i$ .

The integrator outputs were split in fish groups using a combination of behaviour pattern as deduced from echo diagrams, the BEI analysis and catch composition as described below. The following groups were used for Mauritania: 1) sardinellas, 2) sardine, 3) horse mackerels 4) anchovy, 5) chub mackerel, 6) carangids and associated species and 7) demersal fish.

The above equations show that the conversion from  $s_A$ -values to number of fish is dependent on the length composition of the fish. It is therefore important to get representative length distributions from the stock in the whole distribution area.

When the size classes (of e.g. young fish and older fish) are well mixed, the various length distributions can be pooled together with equal importance. Otherwise, when the size classes are segregated, the total distribution area has to be post-stratified, according to the length distributions, and separate estimates are made for the regions containing fish with equal size.

A systematic approach to a) divide the  $s_A$ -value between species in a category of fish (e.g. *Sardinella aurita* and *S. maderensis*) and b) produce pooled length distributions of a target species for use in the above equation and c) calculate the biomass estimates for a region, is obtained through the following procedure:

- The samples of the species in the category (e.g. sardinellas) are respectively pooled together with equal importance (normalized). A sample of 60 flat sardinella in one sample will have equal importance to 30 fish in another sample and not the double weight in accordance with the number of fish in the sample.
- The mean back scattering strength ( $\rho/s_A$ ) of each length frequency distribution of the target species is calculated and summed. This is automatically done if the length distributions are punched into an Excel spreadsheet prepared for the estimation of the abundance of fish (made available onboard 'Dr. Fridtjof Nansen').

- The mean  $s_A$ -value allocated to the category of fish in the region is divided between the species in the same ratio as their relative contribution to the mean back scattering strength of the length groups in the sample (also automatically done in the Excel spread-sheet given that the  $s_A$ -value for the region is punched into the sheet).
- The pooled length distribution is used, together with the mean  $s_A$ -value, to calculate the density (numbers per square NM) by length groups and species, using the above formula. The total number by length group in the area is obtained by multiplying each number by the area. (This is done in the Excel spreadsheet, given that the area of the region is punched into the sheet).
- The numbers are converted to biomass using the estimated weight at length. (Done in the Excel sheet if the condition factor is punched).

## CHAPTER 2 SURVEY RESULTS

---

### 2.1 Weather conditions and hydrography

#### *Wind conditions*

Distribution of wind speed and direction recorded along the survey track is presented in Figure 2.

Weather conditions during the survey were dominated by strong northerly winds in the area north of Nouakchott, Figure 2. These strong winds in this region lead to the intensification of upwelling and coastal currents.

Farther south the wind direction was changed to the westerly, and the hydrography south of Nouakchott was dominated by tropical waters (more than 22 °C).

#### *Hydrography*

Figure 3 shows the distribution of sea surface temperature along the survey track. The characteristic feature of the sea surface temperature to the south of Nouakchott is a predominance of tropical warm surface water >23 °C as a seasonal effect.

North of Cape Timiris to Cape Blanc, the distribution of sea surface temperature is affected by the persistence of the upwelling waters from the north with temperatures <19 °C. The thermal front was located at about 19 °N, which is farther south than normal (20-21 °N).

Figure 4 shows the distribution of temperature, salinity and oxygen in the four profiles.

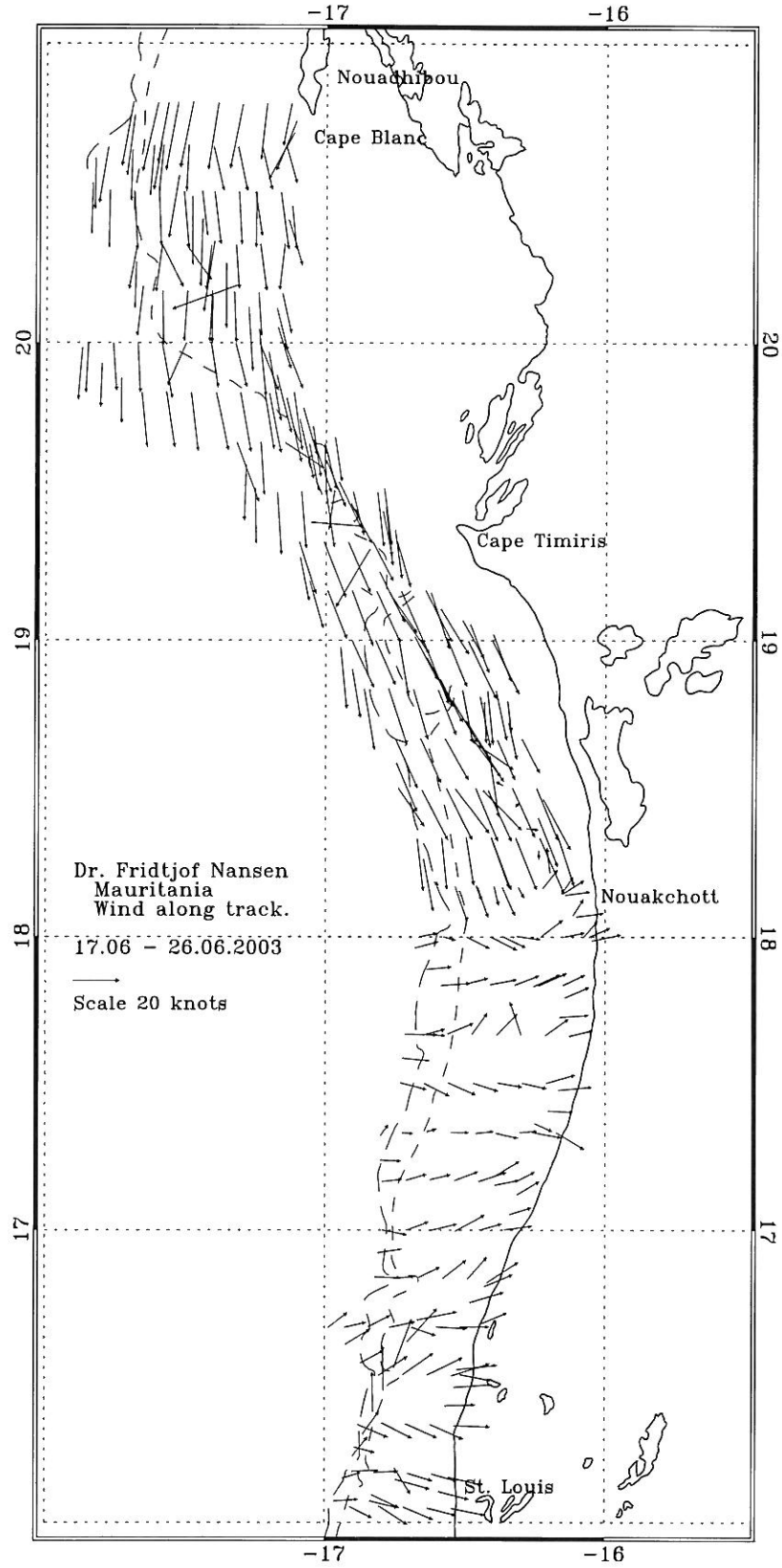


Figure 2. Wind conditions in the surveyed area.

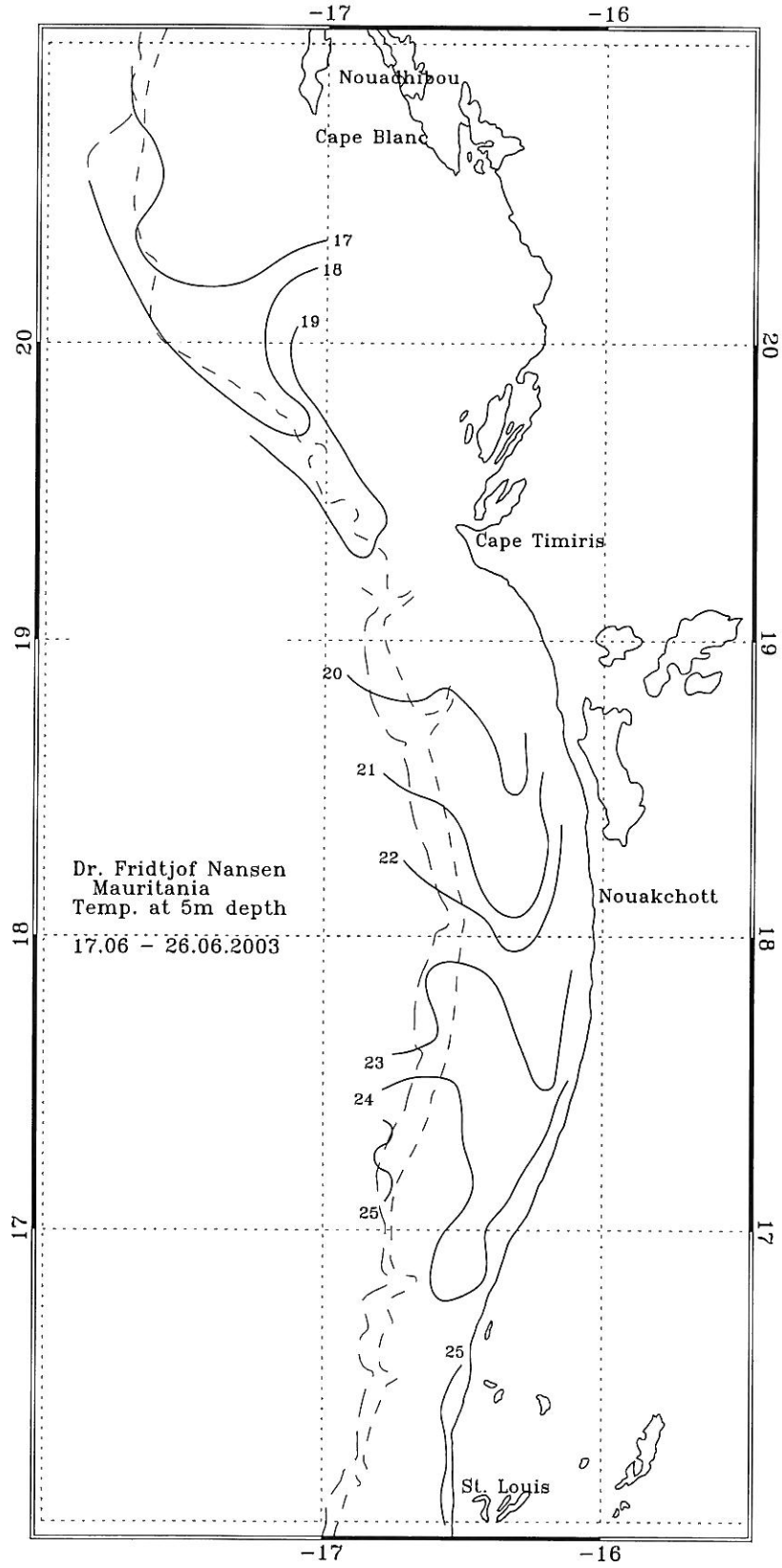


Figure 3. Sea surface temperature.

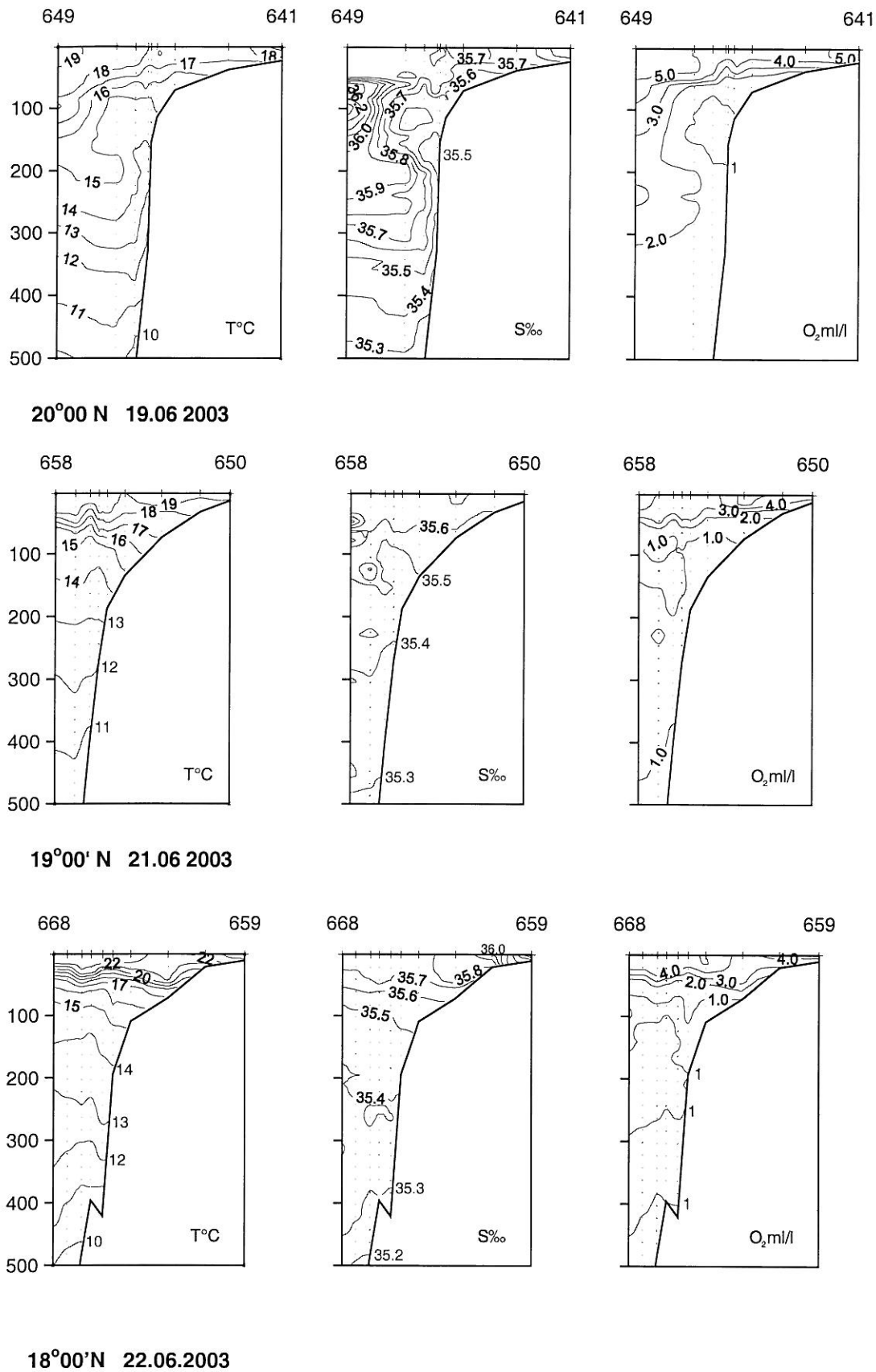
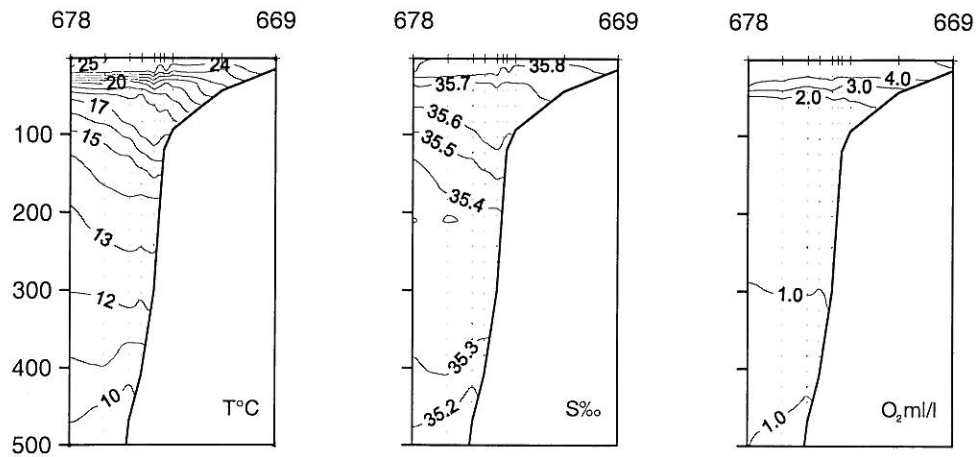


Figure 4. Hydrographic profiles with distribution of temperature, salinity and oxygen.



16°40' N 24.06 2003

Figure 4. continued.

## 2.2 Pelagic fish on the shelf from St. Louis to Cape Timiris

Figure 5 shows the distribution of sardinellas on the shelf of Mauritania.

One concentration of sardinellas were found over the inner shelf in a belt along the coast from about 30 NM north of St. Louis stretching about 60 NM northwards, see Figure 5. Another area with relatively dense schools was found off Cape Timiris.

The samples showed sardinellas of varying size, the round sardinella south of Cape Timiris with modal lengths of 12, 31 and 33 cm, while the flat sardinella had a modal length of 28 cm. Estimated numbers and biomass by length-groups are in Annex IV and the pooled length distribution for the two sardinellas is in Annex III.

Table 1 gives the biomass estimates of sardinellas based on their size composition in the area of sampling. The total estimate in this sub region was 500 thousand tonnes of which 87% was round and 13% flat sardinella.

Table 1. St. Louis to Cape Timiris. Biomass estimates of pelagic fish, thousand tonnes.

Flat sardinella	Round sardinella	Horse mackerels	Anchovy	Other carangids
66	434	280	130	69



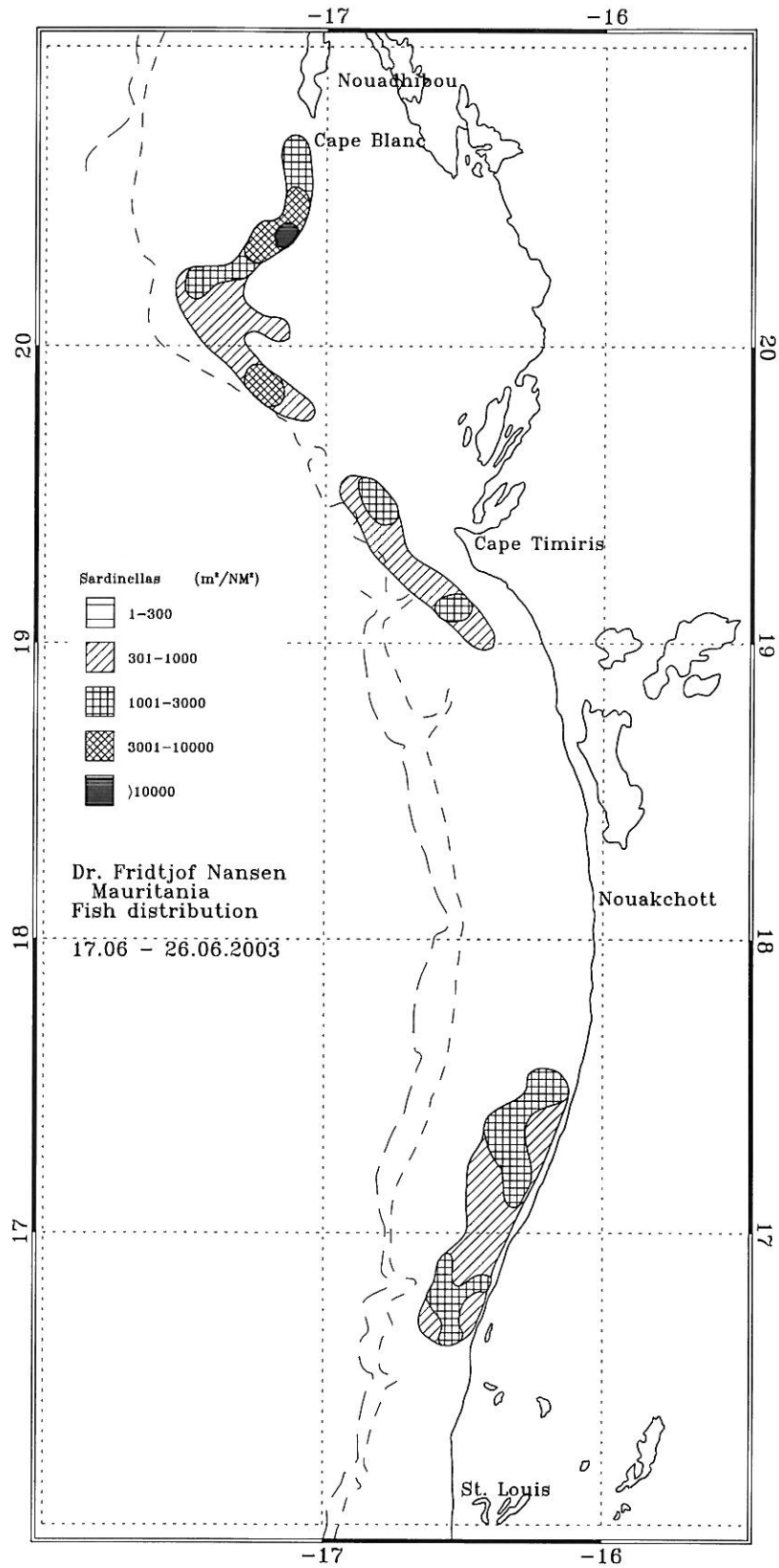


Figure 5. Distribution of sardinellas.

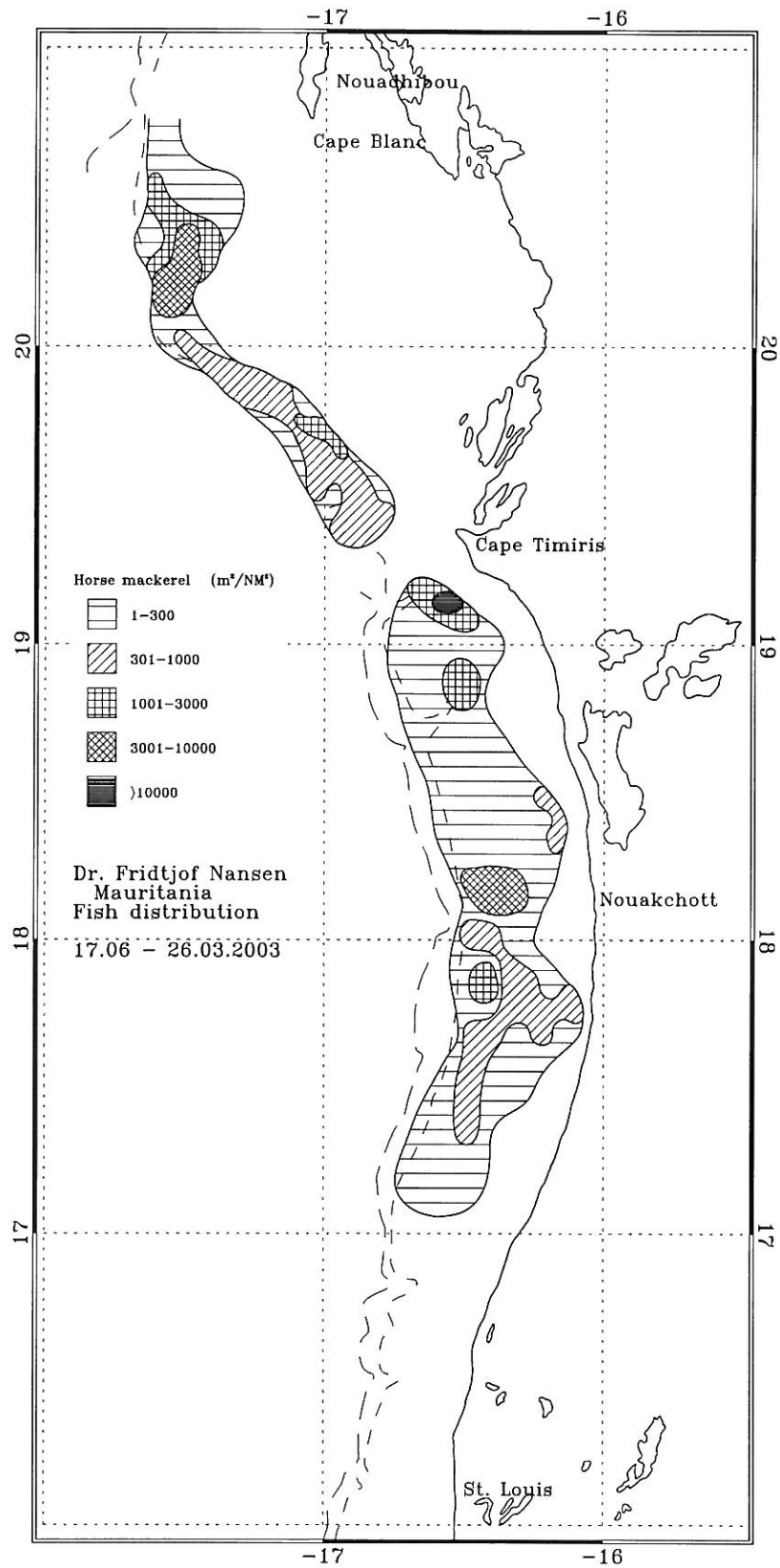


Figure 6. Distribution of horse mackerels.

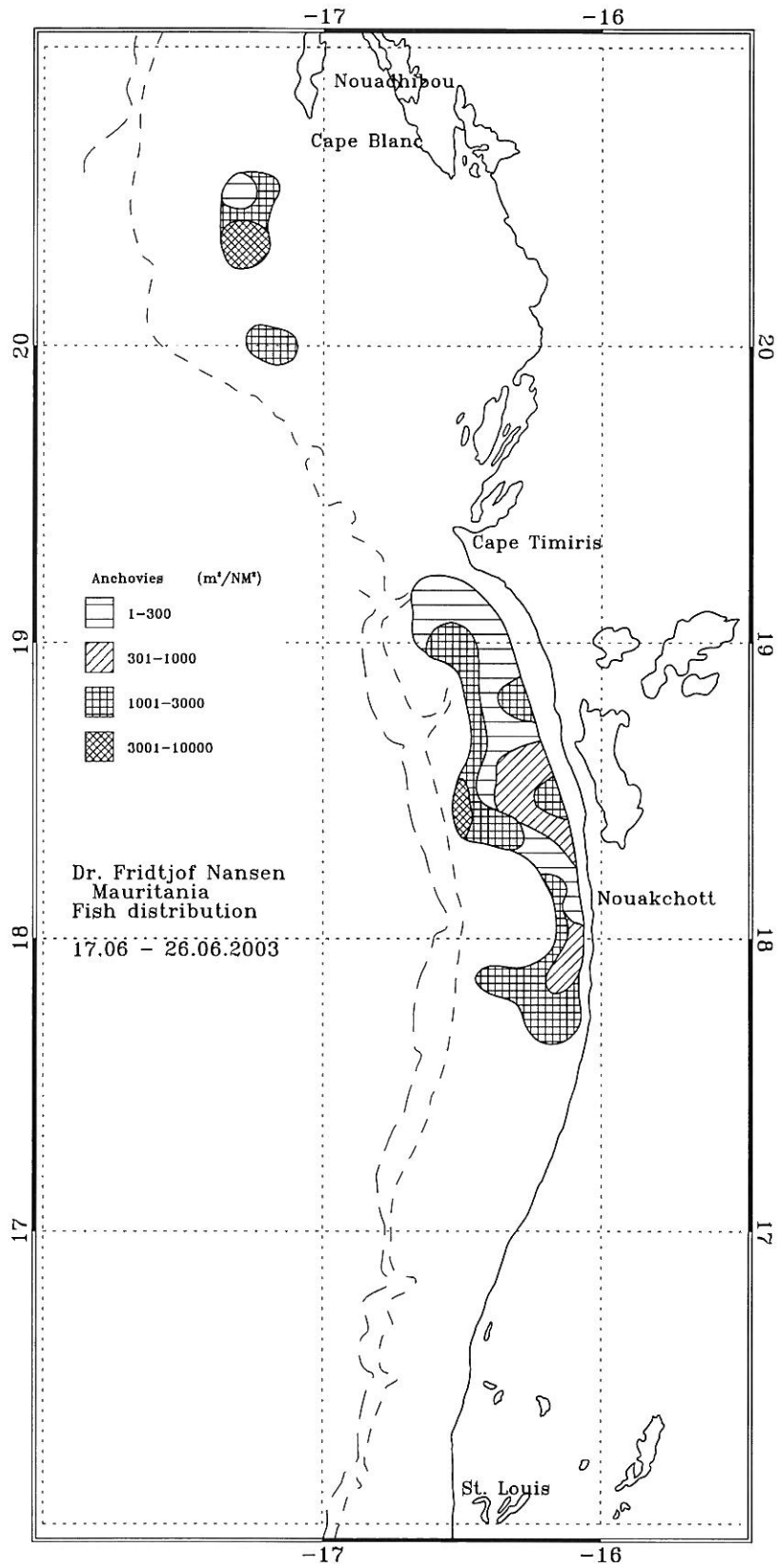


Figure 7. Distribution of anchovy.

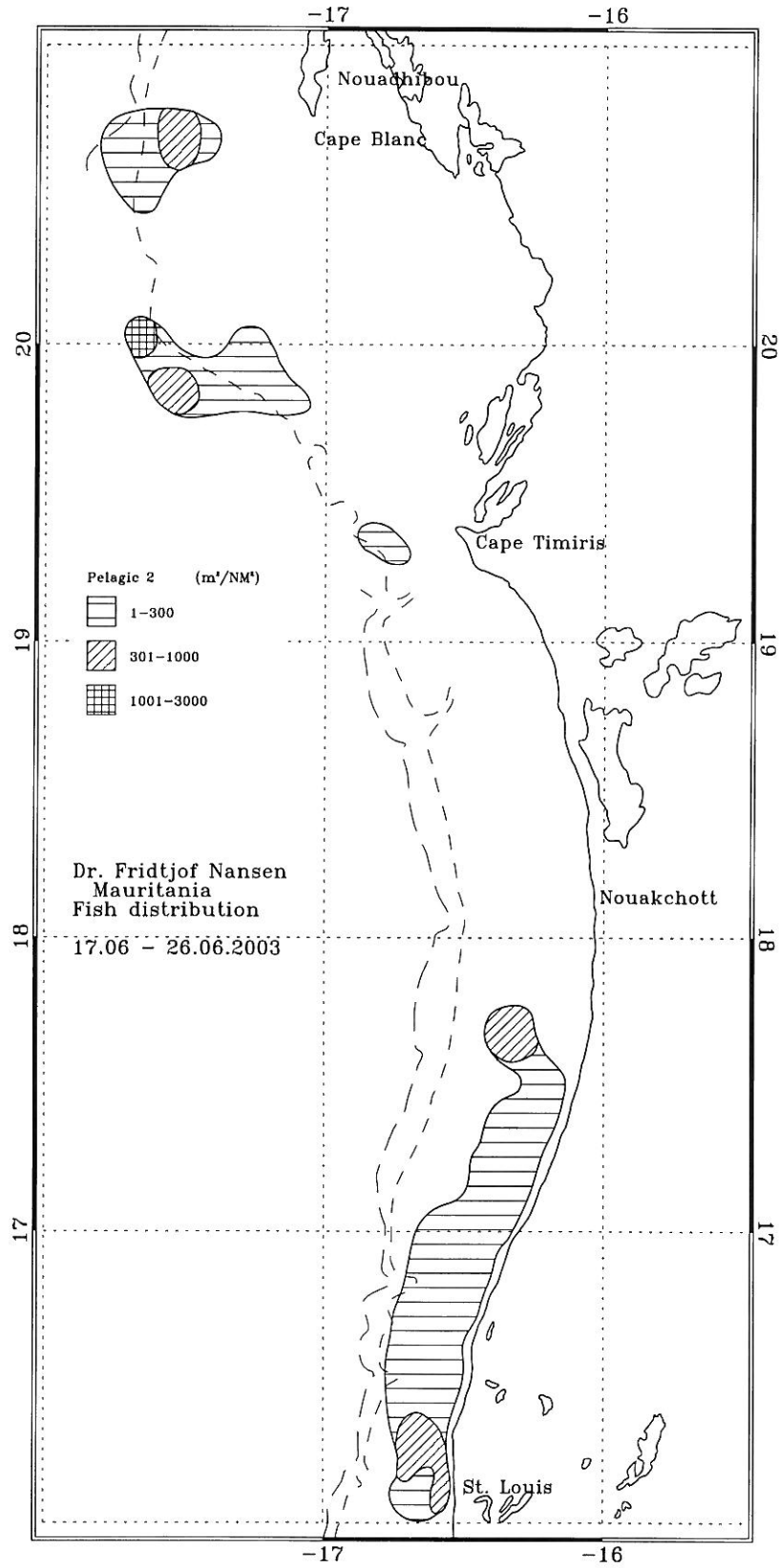


Figure 8. Distribution of carangids and associated species.

The distribution of the Cunene horse mackerel is shown in Figure 6. Horse mackerel occurred in one main concentration; between 17°00'-19°10'N. The most dense concentrations in these aggregations were found at about 18°10'N and at about 19°05'N. The aggregations were found all over the shelf, at daytime close to the bottom at depths around 50-120 m, while at night the fish raised to a more pelagic distribution. The biomass was estimated at 280 thousand tonnes.

Only *Trachurus trecae*, were found, and young individuals dominated totally with a modal lengths of 10 and 14 cm. Estimated number and biomass by length-groups are given in Annex IV, and pooled length distribution by species is in Annex III.

Anchovy was found in a wide area between about 17°40'N – 19°10'N, Figure 7. The biomass was estimated at 131 thousand tonnes. The estimated number and biomass by length group are shown in Annex IV, and the pooled length distribution is in Annex III.

Figure 8 shows the distribution of the other carangids and associated species. Medium to low concentrations were found in the area south of Nouakchott. The total biomass was estimated at 69 thousand tonnes. The samples from the distributional areas consisted of bumper, West African Spanish mackerel, Atlantic bonito, pompano with small amounts of barracudas.

Sardine, *Sardina pilchardus*, were found in two aggregations south of Cape Timiris, Figure 9. One close to Nouakchott and the other, which was much denser, about 20 NM south of Cape Timiris. The aggregations consisted of sardine with modal lengths of 9 and 25 cm. The biomass was estimated at 347 thousand tonnes. The estimated number and biomass by length group are shown in Annex IV, and the pooled length distribution is in Annex III.

### **2.3 Pelagic fish on the shelf from Cape Timiris to Cape Blanc**

There are often aggregations of juvenile fish in the area between Cape Timiris and Cape Blanc, and this year, small sardine, sardinella and horse mackerels were found.

Between Cape Timiris and Cape Blanc, a large aggregation with rather high densities of sardine was recorded, Figure 9. The aggregation was estimated at 460 thousand tonnes.

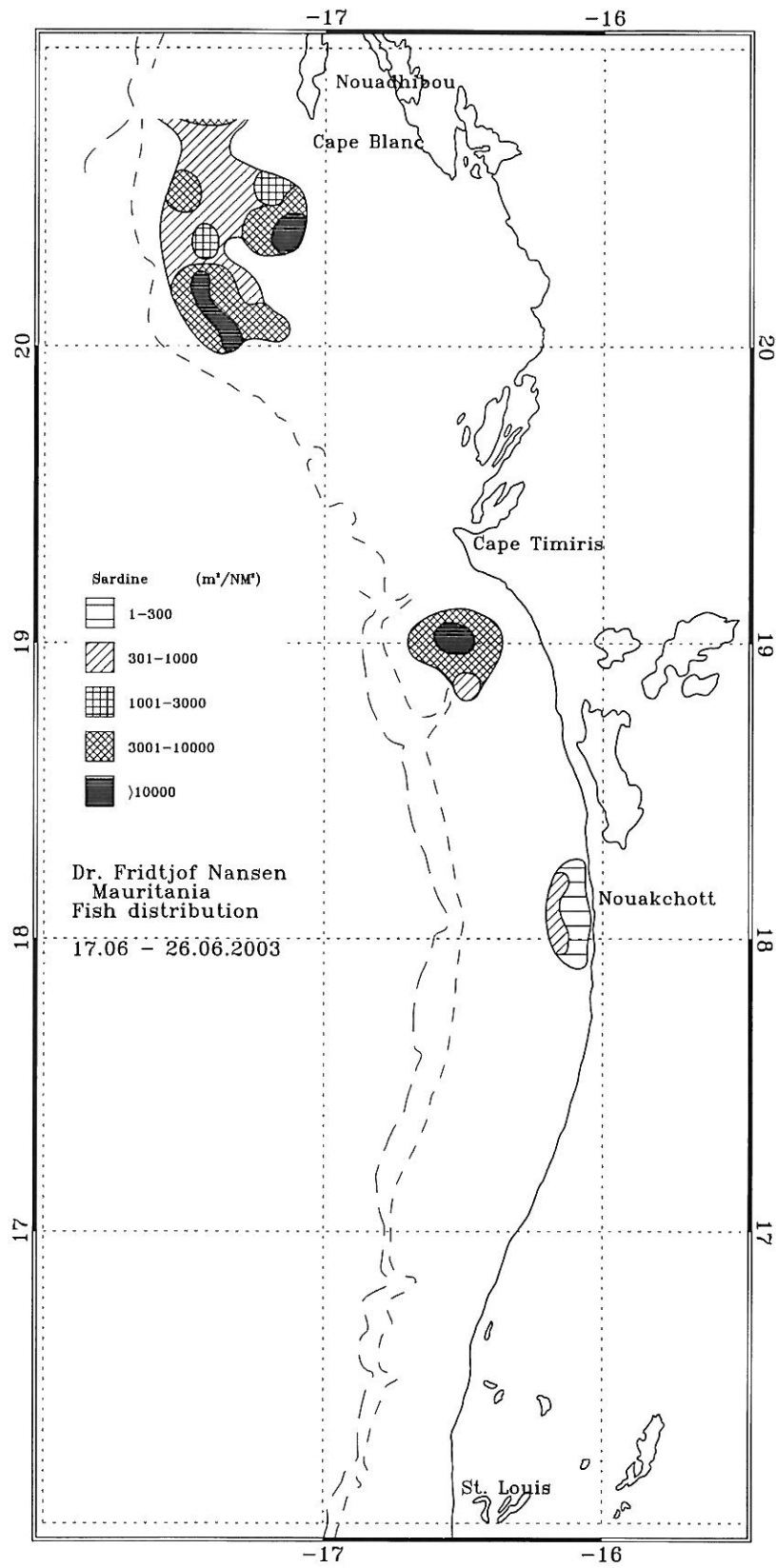


Figure 9. Distribution of sardine. Cape Timiris-Cape Blanc.

The samples showed that small individuals (<16 cm) dominated (estimated at some 10 billion individuals). However, the estimate of small fish in the area must be regarded as uncertain and low because the area, Banc d'Arguin cannot be covered by the vessel. It is believed that a lot of juvenile fish is distributed there. The modal lengths of sardine in the samples of the catches were 12, and 25 cm. The estimated number and biomass by length group are in Annex IV.

Sardinellas were found as a continuous belt of schools over the inner shelf from about 30 NM north of Cape Timiris to Cape Blanc, Figure 5. The concentrations were relatively dense and the estimate was some 386 thousand tonnes, Table 2. Flat sardinella dominated by 60% of the total biomass. The modal lengths of the round sardinella was 13 cm, and for flat sardinella the modal lengths were 12, 18 and 22 cm.

Horse mackerel were recorded continuously along the shelf edge, Figure 6. The aggregations consisted of a mixture between young *Trachurus trachurus*, and somewhat older *Trachurus trecae*. The Cunene horse mackerel dominated the total biomass estimate of 203 thousand tonnes by 89%. The modal length of the Atlantic horse mackerel was 10 cm, and for the Cunene horse mackerel it was 15 cm.

Anchovy were present in two low-density concentrations in the outer parts of the shelf, Figure 7. These were estimated at a biomass of 38 thousand tonnes. However, it is believed that the coverage of anchovy is not complete as there may be fish in the Banc d'Arguin.

Other carangids and associated species were found in two aggregations over the outer part of the shelf, and was estimated at 66 thousand tonnes.

Table 2. Cape Timiris to Cape Blanc. Biomass estimates of pelagic fish, thousand tonnes.

Flat sardinella	Round sardinella	Horse mackerels	Anchovy	Other Carangids etc.
235	151	203	38	66

## CHAPTER 3 OVERVIEW AND SUMMARY OF RESULTS

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The survey was conducted successfully in the period 17 to 26 June with a course track of 1 400 NM and 34 fishing stations, Figure 1.

The hydrographical data show that the temperature is lower than the long-term mean. The thermal front was found somewhat farther south than normal, but at about the same latitude as last year.

Mainly adult round sardinella were found between St. Louis and Cape Timiris, Figure 5, but flat sardinella dominated in the area between Cape Timiris and Cape Blanc. The total biomass estimate of round sardinella was 585 thousand tonnes while for the flat sardinella it was 300 thousand tonnes.

Last year a relatively rich cohort of young round sardinella, with a modal length of 14 cm, was observed and estimated at 8.5 billion individuals. This year a cohort of young individuals is observed with modal length of 13 cm, and estimated at 5.9 billion individuals.

The two species of horse mackerel, the Atlantic and the Cunene horse mackerel were found in a mixture in the area between Cape Timiris and Cape Blanc, while south of Cape Timiris only Cunene horse mackerel were found. The geographical distribution is in Figure 6. The estimate of the Cunene horse mackerel was 460 thousand tonnes, while for the Atlantic horse mackerel it was 23 thousand tonnes. Carangids (not including horse mackerel) and associated species occurred in low densities along the shelf, Figure 8.

Sardine was mainly found in the area between Cape Timiris and Cape Blanc, but two aggregations were also found south of Cape Timiris, Figure 9. The total biomass was estimated at 808 thousand tonnes. Significant amounts of juvenile pilchard were observed, especially in the area between Cape Timiris and Cape Blanc.

The total biomass of the main species is in Table 3, and the geographical distribution and abundance of main species is in Figure 10. For sardinella the total biomass is estimated at 886 thousand tonnes (34% flat and 66% round sardinella), that of horse mackerels at 483 thousand tonnes and that of the carangids and associated species at 135 thousand tonnes.



Table 3 Summary of biomass estimates of pelagic fish, Mauritania, thousand tonnes.

	Flat sardinella	Round sardinella	Horse mackerel	Carangids etc.
Cape Timiris-Cape Blanc	235	151	203	69
St. Louis-Cape Timiris	66	434	280	66
Total	301	585	483	135

The biomass estimates of sardinella and carangids and associated species from previous 'Dr Fridtjof Nansen' surveys of this shelf region is in Table 4. Compared with the estimate in June 2002 in Mauritania, the estimate of 890 thousand tonnes of sardinella from the current survey is somewhat lower. The carangid estimate (including horse mackerels) of 620 thousand tonnes is considerably lower than last years estimate.

Table 4 Biomass estimates from 'Dr. Fridtjof Nansen' surveys of the Mauritanian shelf, thousand tonnes.

Survey:	Sardinellas	Carangids etc.
AprMay-81	20	370
Sept -81	75	*
FebMar-82	50	470
NovDec-86	300	540
FebMar-92	1970	190
NovDec-95	1780	190
NovDec-96	1400	400
NovDec-97	1200	660
NovDec-98	1130	280
NovDec-99	740	560
NovDec-00	930	1 040
June -01	570	670
NovDec-01	230	370
June -02	930	1 130
NovDec-02	320	440
June -03	890	620

\* Not available

## References:

Toresen, R., Gjøsæter, H., and Barros P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research 34 (1998) 27-37.

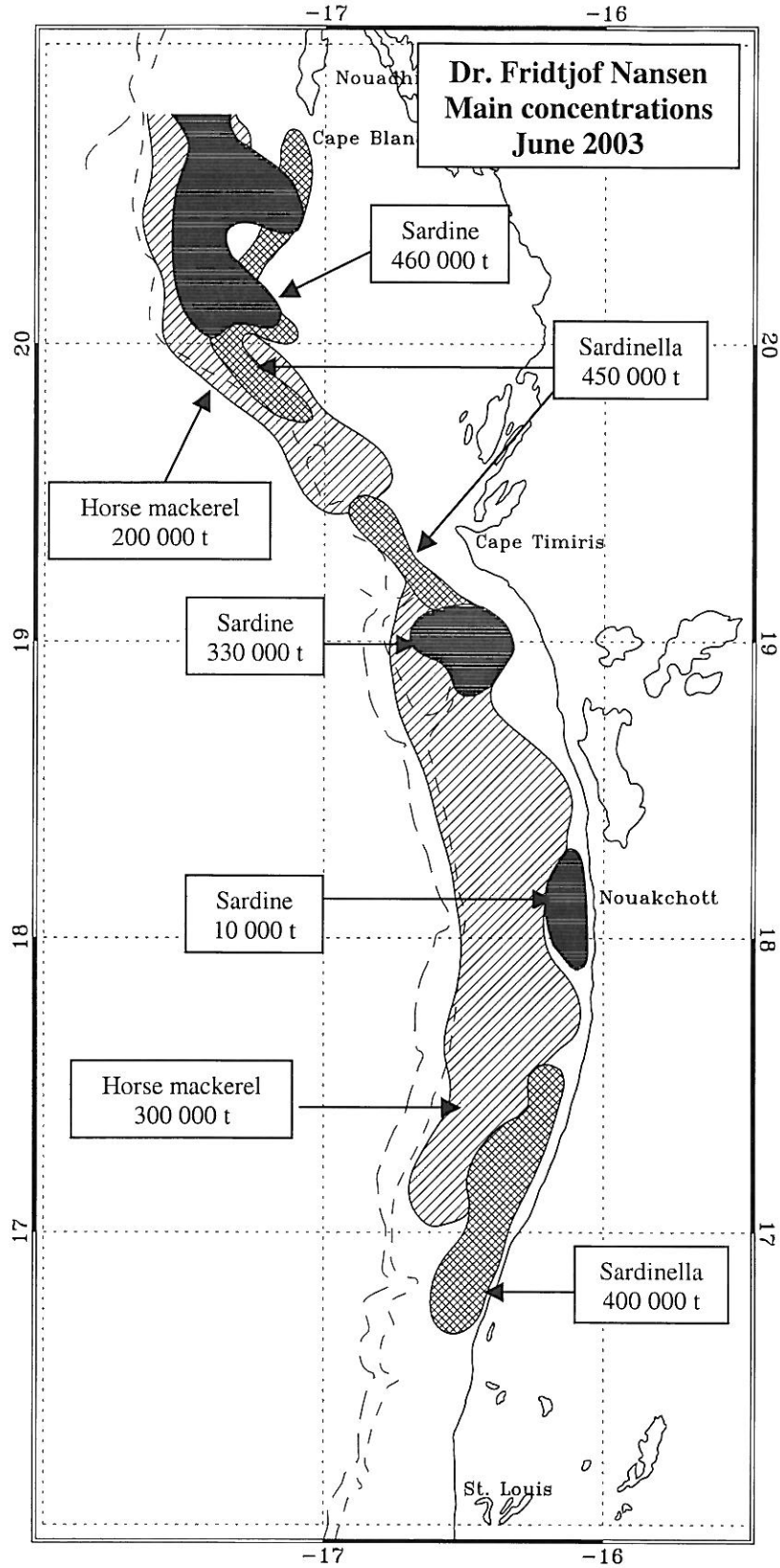


Figure 10. Map of the major pelagic fish concentrations with estimated abundance (tonnes), St. Louis to Cape Blanc.

## RESUME

La campagne a été conduite avec succès durant la période du 17 au 26 Juin, entre Cap Blanc et Saint Louis, selon un schéma de prospection acoustique de 1 400 miles nautiques et 34 stations de pêche de contrôle, (cf. Figure 1).

Les données hydrographiques montrent une température de surface inférieure à la moyenne de la série historique de long terme. Le front thermique a été trouvé plus au sud que l'année précédente.

Les tailles adultes de la sardinelle ronde (*Sardinella aurita*) ont été rencontrées entre St. Louis et Cap Timiris, (cf. Figure 5), mais la sardinelle plate (*Sardinella maderensis*) était dominante dans la zone entre Cap Timiris et Cap Blanc. La biomasse totale de la sardinelle ronde est estimée à 585 mille tonnes alors que celle de la sardinelle plate était de 300 mille tonnes.

Les deux espèces du chinchard, Atlantique et Cunéne (respect. *Trachurus trachurus* et *Trachurus traciae*) ont été trouvées en mélange dans la zone comprise entre Cap Timiris et Cap Blanc, alors que seul le chinchard cunéne fut rencontré au sud de Cap Timiris. La distribution géographique est présentée sur la Figure 6. L'estimatin de biomasse du chinchard Cunéne était de 460 mille tonnes, alors que celle du chinchard Atlantique était de 23 mille tonnes. Les autres Carangidés (chinchards exclus) et espèces associées ont été rencontrées en faible densité sur le plateau continental (cf. Figure 8).

Le pilchard (*Sardina pilchardus*) a été rencontrée dans la zone sud du Cap Blanc, de faibles concentrations ont été également détectées au sud du Cap Timiris (cf. Figure 9). La biomasse totale a été estimée à 808 mille tonnes. D'importantes quantités de juveniles de pilchard ont été observées, spécialement dans la zone entre Cap Timiris et Cap Blanc.

La biomasse totale des principales espèces est présentée dans le Tableau 3, et leur distribution géographique et abondances dans la Figure 10 (cf. page 24). Pour les sardinelles, la biomasse totale est estimée à 886 mille tonnes (66% ronde et 34% plate), celle des chinchards à 483 mille tonnes et celle des autres carangidés et espèces associées à 135 mille tonnes.

Tableau 3. Résumé des estimations de biomasse des poissons pélagiques, Mauritanie, (en mille tonne).

	Sardinelle plate	Sardinelle ronde	Chinchards	Carangids etc.
Cap Timiris-Cap Blanc	235	151	203	69
St. Louis-Cap Timiris	66	434	280	66
Total	301	585	483	135

Le Tableau 4 (cf. page 21) présente les estimations de biomasse des sardinelles et des carangidés avec les espèces associées des campagnes précédentes, du N/R 'Dr Fridtjof Nansen' dans cette région du plateau continental. En comparaison avec les estimations de la campagne de Juin dernier en Mauritanie, L'estimation de 886 mille tonnes de sardinelles actuellement est quelque peu inférieure à celle de Juin 2002. L'estimation de 620 mille tonne de Carangidés (chinchards inclus) est considérablement inférieure au 1 130 mille tonnes de l'année dernière.

# Annex I Records of fishing stations

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1967  
 DATE:18/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2048  
 start stop duration Long W 1732  
 TIME :06:19:09 06:48:54 30 (min) Purpose code: 1  
 LOG :7844.59 7846.65 0.22 Area code : 3  
 FDEPTH: 15 25 GearCond.code:  
 BDEPTH: 83 92 Validity code:  
 Towing dir: 270° Wire out: 100 m Speed: 30 kn\*10  
 Sorted: 40 Kg Total catch: 299.01 CATCH/HOUR: 598.02

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	591.20	4880	98.86	3309
Scomber japonicus	6.82	54	1.14	3308
Total	598.02		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1968  
 DATE:18/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2042  
 start stop duration Long W 1707  
 TIME :10:45:58 10:57:24 11 (min) Purpose code: 1  
 LOG :7882.40 7883.04 2.04 Area code : 3  
 FDEPTH: 18 19 GearCond.code:  
 BDEPTH: 18 19 Validity code:  
 Towing dir: 360° Wire out: 120 m Speed: 33 kn\*10  
 Sorted: 45 Kg Total catch: 45.61 CATCH/HOUR: 248.78

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Diplodus bellottii	165.82	529	66.65	
Decapterus rhonchus	37.09	845	14.91	3311
Dicentrarchus punctatus	17.78	33	7.15	
Pagellus bellottii	11.73	147	4.72	
Sardinella maderensis	8.51	55	3.42	3310
Dentex canariensis	3.87	11	1.56	
Trachinus araneus	3.16	11	1.27	
Spondyliosoma cantharus	0.44	5	0.18	
Loligo vulgaris	0.16	11	0.06	
Lagocephalus laevigatus	0.11	5	0.04	
Boops boops	0.11	5	0.04	
Parapenaeus longirostris	0.05	5	0.02	
Total	248.83		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1969  
 DATE:18/ 6/03 GEAR TYPE: OT No: 2 POSITION:Lat N 2040  
 start stop duration Long W 1737  
 TIME :14:35:29 15:14:54 39 (min) Purpose code: 1  
 LOG :7916.60 7919.23 2.59 Area code : 3  
 FDEPTH: 25 30 GearCond.code:  
 BDEPTH: 93 79 Validity code:  
 Towing dir: 90° Wire out: 120 m Speed: 41 kn\*10  
 Sorted: Kg Total catch: 10.48 CATCH/HOUR: 16.12

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	9.66	68	59.93	3312
Sarda sarda	5.85	12	36.29	
Sphoeroides pachgaster	0.62	3	3.85	
Total	16.13		100.07	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1970  
 DATE:18/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2031  
 start stop duration Long W 1727  
 TIME :20:27:16 20:30:19 3 (min) Purpose code: 1  
 LOG :7968.48 7968.68 0.20 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 58 59 Validity code:  
 Towing dir: 270° Wire out: 120 m Speed: 35 kn\*10  
 Sorted: 34 Kg Total catch: 146.75 CATCH/HOUR: 2935.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	2750.00	31600	93.70	3313
Scomber japonicus	110.00	260	3.75	3314
Sardinella aurita	50.00	200	1.70	
Trachurus trecae	15.00	700	0.51	
Trachurus trachurus	10.00	300	0.34	
Total	2935.00		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1971  
 DATE:18/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2030  
 start stop duration Long W 1716  
 TIME :22:24:31 22:39:08 15 (min) Purpose code: 1  
 LOG :7983.23 7984.20 0.97 Area code : 3  
 FDEPTH: 20 20 GearCond.code:  
 BDEPTH: 38 40 Validity code:  
 Towing dir: 270° Wire out: 95 m Speed: 40 kn\*10  
 Sorted: 37 Kg Total catch: 93.67 CATCH/HOUR: 374.68

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Engraulis encrasicolus	331.20	25500	88.40	3316
Sardina pilchardus	37.00	424	9.88	3315
Trachurus trecae	4.68	204	1.25	
Scomber japonicus	1.08	4	0.29	
Merluccius polli	0.72	4	0.19	
Total	374.68		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1972  
 DATE:19/ 6/03 GEAR TYPE: PT No: 6 POSITION:Lat N 2030  
 start stop duration Long W 1716  
 TIME :23:43:15 00:10:28 27 (min) Purpose code: 1  
 LOG :7987.03 7988.82 1.77 Area code : 3  
 FDEPTH: 5 5 GearCond.code:  
 BDEPTH: 39 38 Validity code:  
 Towing dir: 90° Wire out: 120 m Speed: 41 kn\*10  
 Sorted: 37 Kg Total catch: 625.87 CATCH/HOUR: 1390.82

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1270.84	15220	91.37	3318
Engraulis encrasicolus	115.60	9558	8.31	3317
Trachurus trecae	4.16	189	0.30	
Scomber japonicus	0.16	2	0.01	
Dicologlossa hexophthalma	0.07	2	0.01	
Total	1390.83		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1973  
 DATE:19/ 6/03 GEAR TYPE: PT No: 7 POSITION:Lat N 2025  
 start stop duration Long W 1708  
 TIME :01:43:57 02:05:41 22 (min) Purpose code: 1  
 LOG :8002.86 8004.35 1.49 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 23 23 Validity code:  
 Towing dir: 190° Wire out: 120 m Speed: 41 kn\*10  
 Sorted: 35 Kg Total catch: 281.18 CATCH/HOUR: 766.85

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	448.36	28415	58.47	3321
Sardinella maderensis - Juv.	209.67	8386	27.34	3320
Sardinella aurita - Juveniles	98.84	3761	12.89	3319
Pomatomus saltatrix	3.87	5	0.50	
Trachurus trecae	2.84	22	0.37	
Engraulis encrasicolus	1.31	153	0.17	
Dicentrarchus punctatus	0.85	3	0.11	
Scomber japonicus	0.76	3	0.10	
Decapterus rhonchus	0.22	3	0.03	
Trachinus draco	0.14	3	0.02	
Total	766.86		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1974  
 DATE:19/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2020  
 start stop duration Long W 1735  
 TIME :05:09:09 05:25:50 17 (min) Purpose code: 1  
 LOG :8033.78 8034.92 1.12 Area code : 3  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 75 68 Validity code:  
 Towing dir: 90° Wire out: 110 m Speed: 41 kn\*10  
 Sorted: 13 Kg Total catch: 136.81 CATCH/HOUR: 482.86

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	442.80	44294	91.70	3322
Scomber japonicus	18.32	162	3.79	3323
Trachurus trecae	14.47	918	3.00	3324
Sardina pilchardus	5.08	32	1.05	
Illex coindetii	1.09	4	0.23	
Lagocephalus laevigatus	0.56	4	0.12	
Octopus vulgaris	0.25	4	0.05	
Trachinus draco	0.14	4	0.03	
Total	482.71		99.97	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1975  
 DATE:19/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2010  
 start stop duration Long W 1724  
 TIME :09:45:54 10:05:54 20 (min) Purpose code: 1  
 LOG :8070.64 8070.76 0.11 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 35 35 Validity code:  
 Towing dir: 250° Wire out: 130 m Speed: 40 kn\*10  
 Sorted: 20 Kg Total catch: 6873.30 CATCH/HOUR: 20619.90

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	19919.40	1524807	96.60	3326
Sardinella aurita	706.50	53781	3.43	3325
Total	20625.90		100.03	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1976  
 DATE:20/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1950 Long W 1712  
 start stop duration  
 TIME :00:15:38 00:25:38 10 (min) Purpose code: 1  
 LOG :8190.99 8191.69 0.70 Area code: 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 34 34 Validity code: 1  
 Towing dir: 270° Wire out: 170 m Speed: 40 kn\*10  
 Sorted: 67 Kg Total catch: 375.56 CATCH/HOUR: 2253.36

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella aurita	1400.82 4116	62.17	3327
Trachurus trecae	688.02 24480	30.53	3328
Pomatomus saltatrix	50.70 6	2.25	
Sardinella maderensis	36.30 132	1.61	
Sardina pilchardus	26.40 726	1.17	
Decapterus rhonchus	24.06 132	1.07	
Trachurus trachurus	10.20 1482	0.45	3329
Engraulis encrasicolus	6.90 756	0.31	
Scomber japonicus	3.60 96	0.16	
Sparus caeruleostictus *	3.18 6	0.14	
Loligo vulgaris	2.64 96	0.12	
C R A B S	0.66 66	0.03	
Total	2253.48	100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1977  
 DATE:20/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1940 Long W 1702  
 start stop duration  
 TIME :03:31:01 04:02:31 32 (min) Purpose code: 1  
 LOG :8221.25 8223.30 2.03 Area code: 3  
 FDEPTH: 25 30 GearCond.code:  
 BDEPTH: 492 95 Validity code:  
 Towing dir: 90° Wire out: 130 m Speed: 40 kn\*10  
 Sorted: 3 Kg Total catch: 15.99 CATCH/HOUR: 29.98

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
MYCTOPHIDAE	17.06 13871	56.90	
Trachurus trecae	10.97 296	36.59	3330
Scomber japonicus	1.33 28	4.44	
Synagrops microlepis	0.56 154	1.87	
Trachurus trachurus	0.06 4	0.20	
Total	29.98	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1978  
 DATE:20/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1931 Long W 1658  
 start stop duration  
 TIME :09:04:21 09:17:28 13 (min) Purpose code: 1  
 LOG :8272.55 8273.29 0.73 Area code: 3  
 FDEPTH: 103 100 GearCond.code:  
 BDEPTH: 103 100 Validity code:  
 Towing dir: 175° Wire out: 300 m Speed: 34 kn\*10  
 Sorted: 35 Kg Total catch: 856.26 CATCH/HOUR: 3951.97

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae	3786.92 125585	95.82	3331
Synagrops microlepis	90.00 17169	2.28	
Scomber japonicus	44.31 1108	1.12	
Octopus vulgaris	10.34 9	0.26	
Branchiostegus semifasciatus	10.02 5	0.25	
MURAENIDAE	2.08 5	0.05	
Zeus faber	1.75 5	0.04	
Dentex macrophthalmus	1.66 5	0.04	
Scorpaena stephanica	1.62 55	0.04	
Illex coindetii	1.11 14	0.03	
Merluccius senegalensis	1.06 5	0.03	
Sardina pilchardus	0.92 5	0.02	
Pterotrissus bellocci	0.42 5	0.01	
PORTUNIDAE	0.14 23		
Capros aper	0.05 5		
GALATHEIDAE *	0.05 23		
Total	3952.45	99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1979  
 DATE:20/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1930 Long W 1647  
 start stop duration  
 TIME :11:41:10 12:10:07 29 (min) Purpose code: 1  
 LOG :8293.98 8295.52 1.50 Area code: 3  
 FDEPTH: 18 22 GearCond.code:  
 BDEPTH: 18 22 Validity code:  
 Towing dir: 180° Wire out: 120 m Speed: 31 kn\*10  
 Sorted: 55 Kg Total catch: 653.48 CATCH/HOUR: 1352.03

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella aurita	757.80 2452	56.05	3332
Sardinella maderensis	311.69 1976	23.05	3333
Decapterus rhonchus	205.32 1498	15.19	3334
Chloroscombrus chrysurus	15.23 120	1.13	
Aletris alexandrinus	8.67 6	0.64	
Lagocephalus laevisgatus	8.30 10	0.61	
Pagellus bellottii	7.37 70	0.55	
Camptogramma glaycos	6.66 17	0.49	
Selene dorsalis	6.19 25	0.46	
Pomadourus incisus	3.46 14	0.26	
Raja miraletus	3.14 4	0.23	
Balistes punctatus	2.69 2	0.20	
Diplodus puntazzo	2.61 2	0.19	
Trachurus trachurus	2.38 263	0.18	
Solea senegalensis	2.21 8	0.16	
Trachurus trecae	1.90 263	0.14	
Pastodes helcheri	1.70 2	0.13	
Zeus faber	1.43 2	0.11	
Rhizoprionodon acutus	1.24 2	0.09	
Argyrosomus regius	1.14 4	0.08	
Liza ramada	0.70 2	0.05	
Chelidonichthys lucerna	0.12 2	0.01	
Penaeus notialis	0.06 4		
Total	1352.01	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1980  
 DATE:20/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1910 Long W 1637  
 start stop duration  
 TIME :19:16:54 19:24:44 8 (min) Purpose code: 1  
 LOG :8366.90 8367.34 0.43 Area code: 3  
 FDEPTH: 71 74 GearCond.code:  
 BDEPTH: 71 74 Validity code:  
 Towing dir: 270° Wire out: 230 m Speed: 32 kn\*10  
 Sorted: 24 Kg Total catch: 309.00 CATCH/HOUR: 2317.50

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae	1950.00 9533	84.14	3337
Trachurus trachurus	146.25 13650	6.31	3336
Engraulis encrasicolus	102.38 7605	4.42	3335
Octopus vulgaris	58.50 98	2.52	
Sardina pilchardus	26.33 195	1.14	
PORTUNIDAE	11.70 1853	0.50	
Loligo vulgaris	11.70 488	0.50	
Zeus faber	4.88 98	0.21	
Lesueurigobius sanzei	4.88 1463	0.21	
Synagrops microlepis	0.98 98	0.04	
Total	2317.60	99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1981  
 DATE:20/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1904 Long W 1631  
 start stop duration  
 TIME :21:00:12 21:04:45 5 (min) Purpose code: 1  
 LOG :8379.88 8380.16 0.28 Area code: 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 39 40 Validity code:  
 Towing dir: 300° Wire out: 120 m Speed: 38 kn\*10  
 Sorted: 49 Kg Total catch: 160.43 CATCH/HOUR: 1925.16

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	1556.64 35856	80.86	3338
Sardinella aurita	137.28 576	7.13	3341
Engraulis encrasicolus	94.56 10656	4.91	3342
Trachurus trecae	86.40 6804	4.49	3340
Scomber japonicus	42.24 884	2.19	
Sardinella maderensis	4.20 12	0.22	
Penaeus notialis	1.92 60	0.10	
Pagellus bellottii	0.96 48	0.05	
Trachurus trachurus	0.96 144	0.05	
Total	1925.16	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1982  
 DATE:20/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1900 Long W 1631  
 start stop duration  
 TIME :23:42:13 23:48:13 5 (min) Purpose code: 1  
 LOG :8399.48 8399.80 0.28 Area code: 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 44 45 Validity code:  
 Towing dir: 338° Wire out: 120 m Speed: 30 kn\*10  
 Sorted: 35 Kg Total catch: 369.99 CATCH/HOUR: 4439.88

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Engraulis encrasicolus	1260.00 96084	28.38	3354
Scomber japonicus	135.36 2160	3.05	3345
Trachurus trecae	10.08 792	0.23	3346
Sardinella aurita	7.92 396	0.18	
Trachinus draco	0.96 12	0.02	
Penaeus notialis	0.36 24	0.01	
Total	1414.68	31.87	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1983  
 DATE:21/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1850 Long W 1625  
 start stop duration  
 TIME :08:05:38 08:35:27 30 (min) Purpose code: 1  
 LOG :8464.79 8466.79 1.70 Area code: 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 41 57 Validity code:  
 Towing dir: 270° Wire out: 130 m Speed: 39 kn\*10  
 Sorted: 13 Kg Total catch: 81.66 CATCH/HOUR: 163.32

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Engraulis encrasicolus	112.44 20270	68.85	3347
Sardina pilchardus	42.00 4800	25.72	3348
Scomber japonicus	8.28 192	5.07	
Trachurus trecae	0.36 12	0.22	
Sepia officinalis hierredda	0.12 12	0.07	
Sardinella aurita	0.12 24	0.07	
Total	163.32	100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1984  
 DATE:21/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1849 Long W 1627  
 start stop duration  
 TIME :09:24:06 09:42:05 18 (min) Purpose code: 1  
 LOG :8471.05 8472.27 1.16 Area code: 3  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 55 57 Validity code:  
 Towing dir: 180° Wire out: 90 m Speed: 39 kn\*10  
 Sorted: 54 Kg Total catch: 54.28 CATCH/HOUR: 180.93

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Engraulis encrasicolus	178.33 12793	98.56	3349
Decapterus rhonchus	1.23 3	0.68	
Scomber japonicus	0.73 13	0.40	
MURAENIDAE	0.40 10	0.22	
Sardina pilchardus	0.17 10	0.09	
Trachurus trecae	0.07 10	0.04	
Total	180.93	99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1985  
 DATE:21/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1840  
 start stop duration Long W 1628  
 TIME :13:05:06 13:22:05 17 (min) Purpose code: 1  
 LOG :8503.90 8504.87 0.97 Area code : 3  
 FDEPTH: 75 70 GearCond.code:  
 BDEPTH: 75 70 Validity code:  
 Towing dir: 90ø Wire out: 240 m Speed: 32 kn\*10

Sorted: 35 Kg Total catch: 767.14 CATCH/HOUR: 2707.55

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Engraulis encrasicolus	1615.06 121129	59.65	3351
Trachurus trecae	1067.65 90081	39.43	3350
PORTUNIDAE	16.31 2407	0.60	
Synagrops microlepis	5.44 699	0.20	
GOBIIDAE	1.55 466	0.06	
Merluccius polli	0.78 78	0.03	
Octopus vulgaris	0.74 4	0.03	
L O B S T E R S	0.04 4		
<b>Total</b>	<b>2707.57</b>	<b>100.00</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1986  
 DATE:21/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1830  
 start stop duration Long W 1631  
 TIME :17:42:06 17:55:53 14 (min) Purpose code: 1  
 LOG :8547.27 8547.99 0.70 Area code : 3  
 FDEPTH: 133 146 GearCond.code:  
 BDEPTH: 133 146 Validity code:  
 Towing dir: 270ø Wire out: 400 m Speed: 32 kn\*10

Sorted: 27 Kg Total catch: 1349.00 CATCH/HOUR: 5781.43

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Synagrops microlepis	3308.57 717857	57.23	
Trachurus trecae	975.00 29357	16.86	3352
Merluccius polli	750.00 12429	12.97	
Chlorophthalmus atlanticus	411.43 87429	7.12	
Trichiurus lepturus	132.86 429	2.30	
Schedophilus pamarco	90.00 214	1.56	
GALATHEIDAE *	36.43 214	0.63	
Trachurus trachurus	27.86 43	0.48	
Pontinus kuhlii	17.14 6214	0.30	
Dentex macrophthalmus	10.71 857	0.19	
Microchirus boscanion	8.57 214	0.15	
Parapenaeus longirostris	6.43 643	0.11	
Zenopsis conchifer	4.29 214	0.07	
<b>Total</b>	<b>5779.29</b>	<b>99.97</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1987  
 DATE:21/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1830  
 start stop duration Long W 1626  
 TIME :19:13:24 19:43:11 30 (min) Purpose code: 1  
 LOG :8557.36 8559.37 1.98 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 89 71 Validity code:  
 Towing dir: 270ø Wire out: 135 m Speed: 40 kn\*10

Sorted: 34 Kg Total catch: 273.12 CATCH/HOUR: 546.24

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Engraulis encrasicolus	544.80 40860	99.74	3353
Scomber japonicus	1.34 32	0.25	
<b>Total</b>	<b>546.14</b>	<b>99.99</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1988  
 DATE:22/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1820  
 start stop duration Long W 1624  
 TIME :00:36:37 00:53:17 17 (min) Purpose code: 1  
 LOG :8604.12 8605.30 1.17 Area code : 3  
 FDEPTH: 20 25 GearCond.code:  
 BDEPTH: 76 70 Validity code:  
 Towing dir: 90ø Wire out: 110 m Speed: 42 kn\*10

Sorted: 35 Kg Total catch: 106.48 CATCH/HOUR: 375.81

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Engraulis encrasicolus	370.59 28260	98.61	3354
Trachurus trecae	3.14 166	0.84	
Scomber japonicus	1.34 32	0.36	
OPHICHTHIDAE	0.18 11	0.05	
Synagrops microlepis	0.14 25	0.04	
Trachinus draco	0.14 4	0.04	
Trachurus trachurus	0.11 11	0.03	
Lesueurigobius sanzoi	0.07 25	0.02	
Illex coindetii	0.04 4	0.01	
Saurida brasiliensis	0.04 4	0.01	
<b>Total</b>	<b>375.79</b>	<b>100.01</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1989  
 DATE:22/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1810  
 start stop duration Long W 1628  
 TIME :04:53:59 05:12:35 19 (min) Purpose code: 1  
 LOG :8643.31 8644.67 1.34 Area code : 3  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 108 136 Validity code:  
 Towing dir: 270ø Wire out: 110 m Speed: 42 kn\*10

Sorted: 27 Kg Total catch: 135.30 CATCH/HOUR: 427.26

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Trachurus trecae	386.84 11368	90.54	3355
Synagrops microlepis	40.11 15332	9.39	
Sphaeroides spengleri	0.32 237	0.07	
<b>Total</b>	<b>427.27</b>	<b>100.00</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1990  
 DATE:22/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1810  
 start stop duration Long W 1622  
 TIME :06:38:32 07:00:53 22 (min) Purpose code: 2  
 LOG :8655.43 8656.80 1.36 Area code : 3  
 FDEPTH: 25 50 GearCond.code:  
 BDEPTH: 69 77 Validity code:  
 Towing dir: 270ø Wire out: 150 m Speed: 35 kn\*10

Sorted: 28 Kg Total catch: 142.10 CATCH/HOUR: 387.55

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Trachurus trecae	381.82 36987	98.52	3356
Sarda sarda	5.73 14	1.48	
<b>Total</b>	<b>387.55</b>	<b>100.00</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1991  
 DATE:22/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1809  
 start stop duration Long W 1609  
 TIME :09:19:49 09:29:21 10 (min) Purpose code: 1  
 LOG :8675.44 8675.98 0.54 Area code : 3  
 FDEPTH: 17 17 GearCond.code:  
 BDEPTH: 17 17 Validity code:  
 Towing dir: 328ø Wire out: 120 m Speed: 34 kn\*10

Sorted: 21 Kg Total catch: 1931.00 CATCH/HOUR: 11586.00

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Engraulis encrasicolus	7440.00 999000	64.22	3358
Sardina pilchardus	4020.00 418800	34.70	3357
Scomber japonicus	43.20 9900	0.37	
Sarda sarda	39.00 300	0.34	
PORTUNIDAE	15.00 300	0.13	
Dicologlossa cuneata	15.00 300	0.13	
Sardinella aurita	15.00 900	0.13	
<b>Total</b>	<b>11587.20</b>	<b>100.02</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1992  
 DATE:22/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1800  
 start stop duration Long W 1622  
 TIME :13:23:05 13:45:41 23 (min) Purpose code: 1  
 LOG :8707.61 8708.86 1.23 Area code : 3  
 FDEPTH: 87 81 GearCond.code:  
 BDEPTH: 87 81 Validity code:  
 Towing dir: 90ø Wire out: 260 m Speed: 32 kn\*10

Sorted: 61 Kg Total catch: 1829.39 CATCH/HOUR: 4772.32

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Trachurus trecae, juvenile	4678.96 350922	98.04	3359
Trachurus trecae	52.41 143	1.10	3360
Zeus faber	18.47 230	0.39	
Dentex macrophthalmus	8.77 44	0.18	
Sciaenops ocellatus	4.62 3	0.10	
Scorpaena stephanica	3.08 8	0.06	
Ubrina canariensis	2.61 5	0.05	
Uranoscopus polli	1.98 3	0.04	
Dentex canariensis	1.41 3	0.03	
Dentex maroccanus	0.03 3		
<b>Total</b>	<b>4772.34</b>	<b>99.99</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1993  
 DATE:22/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1750  
 start stop duration Long W 1616  
 TIME :21:08:15 21:28:08 20 (min) Purpose code: 1  
 LOG :8763.29 8764.50 1.19 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 63 68 Validity code:  
 Towing dir: 270ø Wire out: 123 m Speed: 37 kn\*10

Sorted: 31 Kg Total catch: 1633.15 CATCH/HOUR: 4899.45

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Engraulis encrasicolus	3142.50 351021	64.14	3361
Trachurus trecae	1467.00 169167	29.94	3362
Decapterus rhonchus	155.10 468	3.17	3363
Pomatomus saltatrix	65.10 27	1.33	
Loligo vulgaris	33.00 750	0.67	
Sardinella aurita	22.05 66	0.45	
Sphyrna guachancho	11.85 27	0.24	
Remora remora	2.85 3	0.06	
<b>Total</b>	<b>4899.45</b>	<b>100.00</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1994  
 DATE:23/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1740  
 start stop duration Long W 1641  
 TIME :03:31:49 03:57:44 26 (min) Purpose code: 1  
 LOG :8821.31 8823.05 1.90 Area code : 3  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 581 413 Validity code:  
 Towing dir: 90ø Wire out: 110 m Speed: 41 kn\*10

Sorted: 19 Kg Total catch: 19.31 CATCH/HOUR: 44.56

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	36.00 52200	80.79	
Taractes sp.	4.52 7	10.14	
Trachipterus jacksonensis	2.52 5	5.66	
Trachurus trecae	1.29 5	2.89	
Lestidium atlanticum	0.12 12	0.27	
Onychoteuthis banksi	0.07 5	0.16	
Serranus accraensis	0.02 5	0.04	
Selene dorsalis	0.02 65	0.04	
<b>Total</b>	<b>44.56</b>	<b>99.99</b>	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1995  
 DATE:23/ 6/03 GEAR TYPE: PT No: 6 POSITION:Lat N 1721  
 start stop duration Long W 1615  
 TIME :11:10:15 11:30:08 20 (min) Purpose code: 1  
 LOG :8893.52 8894.80 1.28 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 33 33 Validity code:  
 Towing dir: 205ø Wire out: 135 m Speed: 38 kn\*10

Sorted: 63 Kg Total catch: 733.19 CATCH/HOUR: 2199.57

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	2063.10	5934	93.80	3364
Sardinella maderensis	90.72	243	4.12	
Sarda sarda	18.30	9	0.83	
Scomberomorus tritor	13.20	6	0.60	
Pomadasys rogeri	6.03	6	0.27	
Chloroscombrus chrysurus	5.85	33	0.27	
Alectis alexandrinus	2.37	3	0.11	
Total	2199.57		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1996  
 DATE:23/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 1711  
 start stop duration Long W 1624  
 TIME :18:40:49 19:10:07 29 (min) Purpose code: 1  
 LOG :8963.64 8965.45 1.78 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 55 54 Validity code:  
 Towing dir: 196ø Wire out: 140 m Speed: 38 kn\*10

Sorted: 62 Kg Total catch: 62.91 CATCH/HOUR: 130.16

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	58.76	172	45.14	3365
Sardinella maderensis	43.34	182	33.30	3366
Sarda sarda	24.41	21	18.75	
Campegramma grayceus	1.41	2	1.08	
Sphyræna guanchancho	1.37	4	1.05	
Trachinotus ovatus	0.58	2	0.45	
Sepiella ornata	0.25	37	0.19	
Ephippion guttifer	0.02	2	0.02	
Selene dorsalis	0.02	6	0.02	
Total	130.16		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1997  
 DATE:24/ 6/03 GEAR TYPE: PT No: 7 POSITION:Lat N 1647  
 start stop duration Long W 1627  
 TIME :03:52:53 04:05:48 13 (min) Purpose code: 1  
 LOG :9050.66 9051.65 0.98 Area code : 3  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 21 21 Validity code:  
 Towing dir: 40ø Wire out: 100 m Speed: 42 kn\*10

Sorted: 34 Kg Total catch: 208.85 CATCH/HOUR: 963.92

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	733.85	2437	76.13	3367
Brachydeuterus auritus	77.26	748	8.02	
Sardinella maderensis	76.43	415	7.93	
Chloroscombrus chrysurus	49.02	415	5.09	
Decapterus rhonchus	16.89	138	1.75	
Pomatomus saltatrix	3.46	5	0.36	
Pomadasys rogeri	3.18	5	0.33	
Trachinotus ovatus	2.86	14	0.30	
Galeoides decadactylus	0.60	5	0.06	
Selene dorsalis	0.37	5	0.04	
Total	963.92		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1998  
 DATE:24/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1631  
 start stop duration Long W 1632  
 TIME :15:07:24 15:43:50 36 (min) Purpose code: 1  
 LOG :9133.35 9135.32 1.97 Area code : 3  
 FDEPTH: 25 23 GearCond.code:  
 BDEPTH: 25 23 Validity code:  
 Towing dir: 165ø Wire out: 200 m Speed: 31 kn\*10

Sorted: 32 Kg Total catch: 357.27 CATCH/HOUR: 595.45

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	197.75	1762	33.21	
Eucinostomus melanopterus	152.83	1563	25.27	
Drepane africana	52.92	60	8.89	
Sparus caeruleostictus *	34.00	103	5.71	
Pomadasys jubelini	21.33	75	3.58	
Plesionika martia	20.42	40	3.43	
Galeoides decadactylus	20.08	60	3.37	
Decapterus rhonchus	15.05	93	2.53	
Pomadasys rogeri	13.67	33	2.30	
Mycteroperca rubra	8.33	2	1.40	
Alectis alexandrinus	6.33	12	1.06	
Sardinella aurita	6.30	23	1.06	
Lithognathus motacrus	5.50	8	0.92	
Caranx senegallus	5.15	12	0.86	
Chaetodipterus gorenensis	4.83	8	0.81	
Pseudupeneus prayensis	4.28	33	0.72	
Dentex canariensis	3.03	13	0.51	
Pagellus bellottii	2.93	23	0.49	
Diplodus vulgaris	2.72	7	0.46	
Torpedo torpedo	2.18	2	0.37	
Pseudotolithus senegalensis	1.78	2	0.30	
Trachinotus ovatus	1.73	3	0.29	
Diplodus cervinus	1.60	2	0.27	
Chaetodon hoefleri	1.57	10	0.26	
Sphyræna guanchancho	1.33	5	0.22	
Scomberomorus tritor	1.30	2	0.22	
Echeneis naucrates	1.25	3	0.21	
Raja miraletus	1.17	10	0.20	
Sphyrna lewini	1.05	2	0.18	
Chelidonicichthys sp.	1.05	2	0.18	
Balistes punctatus	0.78	2	0.13	
Bodianus speciosus	0.58	2	0.10	
Selene dorsalis	0.45	2	0.08	
Sepia officinalis hierredda	0.12	2	0.02	
Penaeus notialis	0.03	2	0.01	
Total	595.42		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:1999  
 DATE:24/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1612  
 start stop duration Long W 1645  
 TIME :21:58:59 22:58:26 59 (min) Purpose code: 1  
 LOG :9193.98 9197.19 3.29 Area code : 3  
 FDEPTH: 89 85 GearCond.code:  
 BDEPTH: 89 85 Validity code:  
 Towing dir: 185ø Wire out: 280 m Speed: 32 kn\*10

Sorted: 79 Kg Total catch: 157.09 CATCH/HOUR: 159.75

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	32.44	41	20.31	
Octopus vulgaris	28.63	36	17.92	
GOBIIDAE	16.84	8420	10.54	
Synagrops microlepis	16.78	3356	10.50	
Parapenaeus longirostris	15.86	4296	9.93	
Dentex canariensis	13.90	98	8.70	
Pterothrissus belloci	6.96	348	4.36	
Merluccius senegalensis	6.71	293	4.20	
Brotula barbata	4.82	18	3.02	
Chelidonicichthys gabonensis	4.13	43	2.59	
Trichurus lepturus	2.54	11	1.59	
Gadella imberbis	2.32	18	1.45	
Torpedo torpedo	1.89	3	1.18	
Zeus faber	1.71	24	1.07	
C R A B S	1.53	2178	0.96	
Trachurus trecae, juvenile	1.22	207	0.76	
Serranus cabrilla	0.73	12	0.46	
Scorpaena stephanica	0.32	1	0.20	
Squilla mantis	0.24	67	0.15	
Dicologlossa hexophthalma	0.12	6	0.08	
Arnoglossus imperialis	0.06	24	0.04	
Total	159.75		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2000  
 DATE:25/ 6/03 GEAR TYPE: BT No: 2 POSITION:Lat N 1604  
 start stop duration Long W 1650  
 TIME :03:43:05 04:43:10 60 (min) Purpose code: 1  
 LOG :9240.40 9243.33 2.92 Area code : 3  
 FDEPTH: 103 101 GearCond.code:  
 BDEPTH: 103 101 Validity code:  
 Towing dir: 20ø Wire out: 300 m Speed: 31 kn\*10

Sorted: 29 Kg Total catch: 170.88 CATCH/HOUR: 170.88

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
GALATHEIDAE	64.95	32475	38.01	
Parapenaeus longirostris	48.71	6166	28.51	
Synagrops microlepis	17.85	2380	10.45	
Lesueurigobius sanzoi	14.65	4885	8.57	
Merluccius senegalensis	5.09	9	2.98	
Octopus vulgaris	4.90	9	2.87	
Dentex canariensis	3.45	14	2.02	
Zeus faber	3.07	10	1.80	
Pagellus bellottii	2.17	11	1.27	
Brotula barbata	1.78	7	1.04	
Scorpaena stephanica	1.56	6	0.91	
Trichurus lepturus	0.90	2	0.53	
Loligo vulgaris	0.83	3	0.48	
SCYLLARIDAE	0.70	55	0.41	
C R A B S	0.18	19	0.11	
Squilla mantis	0.05	4	0.03	
Serranus cabrilla	0.04	4	0.02	
Total	170.88		100.02	



## Annex II Instruments and fishing gear used

The Simrad EK-500, 38kHz echo scientific sounder was used during the survey for fish abundance estimation. The Bergen Echo Integrator system (BEI) logging the echogram raw data from the sounder, was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape, and a backup of the database of scrutinized data, stored. The details of the settings of the 38kHz were as follows:

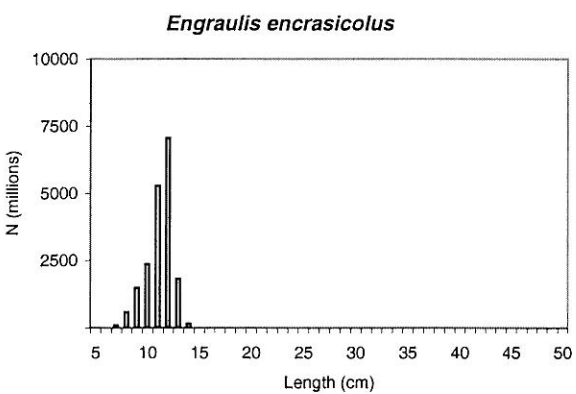
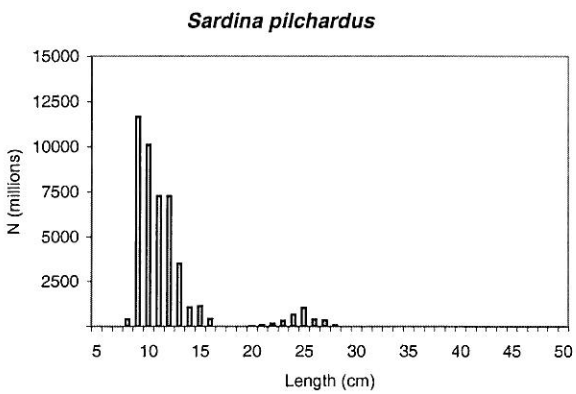
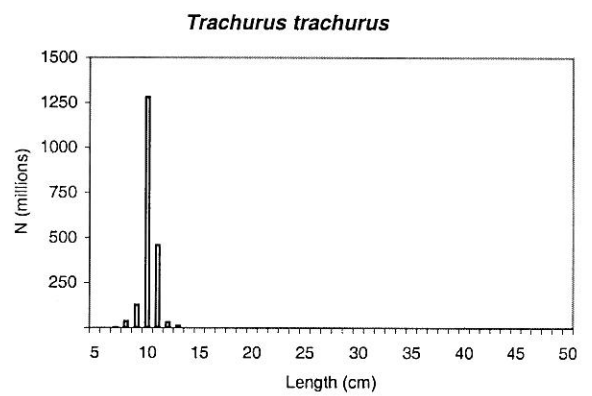
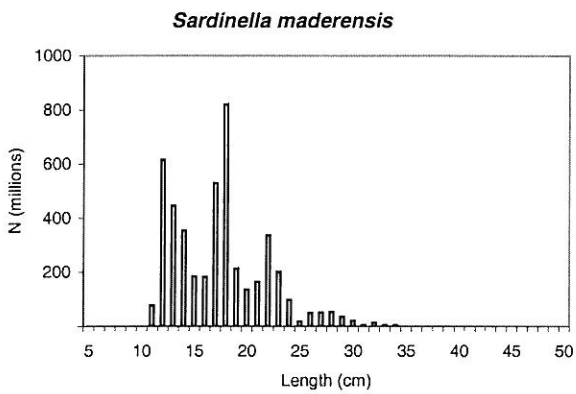
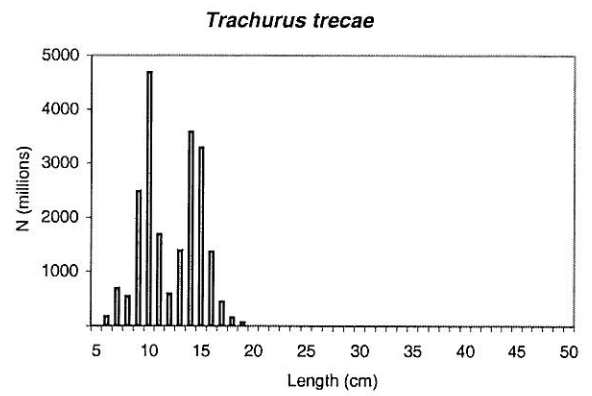
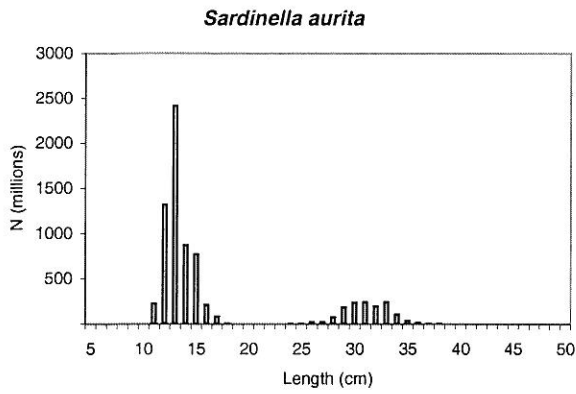
<b>Transceiver-1 menu</b>	Transducer depth	5.5 m
	Absorption coeff.	10 dB/km
	Pulse length	medium (1ms)
	Bandwidth	wide
	Max power	2000 Watt
	2-way beam angle	-21.0 dB
	SV transducer gain	27.01 dB
	TS transducer gain	27.14 dB
	Angle sensitivity	21.9
	3 dB beamwidth along.	6.8°
	3 dB beamwidth athw.	6.8°
	Alongship offset	-0.05°
	Athwardship offset	0.09°
<b>Display menu</b>	Echogram	1
	Bottom range	10 m
	Bottom range start	9 m
	TVG	20 log R
	Sv colour min	-67 dB
	TS Colour minimum	-60 dB
<b>Printer- menu</b>	Range	0-50, 0-100, 0-150, 0-250 or 0-500m
	TVG	20 log R
	Sv colour min	-60 dB
<b>Bottom detection menu</b>	Minimum level	-40 dB

A calibration experiment using a standard copper sphere was performed in Langstrand, Namibia on 22 April 2003.

### Fishing gear

The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super" bottom trawl. For all trawls, the Tyborøn, 7.8m<sup>2</sup> (1670 kg) trawl doors were used.

## Annex III Pooled length distributions by species



## Annex IV Estimates of numbers and weight by length

Mauritania, June 2003

### *Sardinella aurita*

Length cm	N (thousands)			Biomass (tonnes)		
	Cape Timiris- Cape Blanc	St.Louis- Cape Timiris	TOTAL	Cape Timiris- Cape Blanc	St.Louis- Cape Timiris	TOTAL
5						
6						
7						
8						
9						
10						
11	225 294		225 294	3 289		3 289
12	1 305 249	12 485	1 317 734	24 473	234	24 708
13	2 409 307	8 323	2 417 630	56 907	197	57 103
14	864 093	4 162	868 254	25 289	122	25 411
15	765 189	4 162	769 351	27 355	149	27 504
16	210 959		210 959	9 097		9 097
17	82 245		82 245	4 232		4 232
18	8 944		8 944	544		544
19						
20						
21						
22						
23		1 152	1 152		144	144
24		4 609	4 609		651	651
25		3 457	3 457		550	550
26		20 111	20 111		3 593	3 593
27		20 972	20 972		4 187	4 187
28		74 693	74 693		16 599	16 599
29		187 514	187 514		46 214	46 214
30		235 988	235 988		64 278	64 278
31		244 114	244 114		73 248	73 248
32		198 285	198 285		65 345	65 345
33		244 106	244 106		88 102	88 102
34		106 300	106 300		41 904	41 904
35		37 449	37 449		16 084	16 084
36		17 142	17 142		8 002	8 002
37		5 283	5 283		2 674	2 674
38		2 641	2 641		1 447	1 447
39						
40						
<b>TOTAL</b>	<b>5 871 280</b>	<b>1 432 946</b>	<b>7 304 227</b>	<b>151 186</b>	<b>433 723</b>	<b>584 909</b>

## Annex IV continued

Mauritania, June 2003

### *Sardinella maderensis*

Length cm	N (thousands)			Biomass (tonnes)		
	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL
5						
6						
7						
8						
9						
10						
11	76 976		76 976	1 124		1 124
12	615 807		615 807	11 546		11 546
13	446 460		446 460	10 545		10 545
14	354 089		354 089	10 363		10 363
15	184 742		184 742	6 604		6 604
16	182 897		182 897	7 887		7 887
17	529 606		529 606	27 248		27 248
18	820 890		820 890	49 897		49 897
19	211 842	1 189	213 031	15 080	85	15 164
20	132 402	3 566	135 967	10 950	295	11 245
21	158 882	5 943	164 825	15 159	567	15 726
22	317 764	19 017	336 781	34 747	2 080	36 827
23	185 362	16 640	202 002	23 094	2 073	25 167
24	79 441	18 093	97 534	11 215	2 554	13 770
25		17 697	17 697		2 817	2 817
26		49 658	49 658		8 871	8 871
27		51 110	51 110		10 204	10 204
28		53 487	53 487		11 887	11 887
29		35 262	35 262		8 691	8 691
30		20 867	20 867		5 684	5 684
31		5 283	5 283		1 585	1 585
32		13 207	13 207		4 352	4 352
33		5 283	5 283		1 907	1 907
34		5 283	5 283		2 083	2 083
35						
36						
37						
38						
39						
40						
<b>TOTAL</b>	<b>4 297 159</b>	<b>321 583</b>	<b>4 618 741</b>	<b>235 460</b>	<b>65 733</b>	<b>301 194</b>

## Annex IV continued

Mauritania, June 2003

### *Sardina pilchardus*

Length cm	N (thousands)			Biomass (tonnes)		
	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL
5						
6						
7						
8	11 427	220 716	232 143	58	1 111	1 169
9	295 467	6 377 527	6 672 993	2 077	44 837	46 914
10	848 259	8 255 079	9 103 338	8 052	78 362	86 414
11	2 132 982	3 876 164	6 009 146	26 601	48 340	74 941
12	3 226 382	531 007	3 757 389	51 673	8 504	60 177
13	1 391 847		1 391 847	28 081		28 081
14	983 386		983 386	24 583		24 583
15	1 132 892		1 132 892	34 594		34 594
16	414 628		414 628	15 273		15 273
17						
18						
19						
20	25 486		25 486	1 800		1 800
21	93 295		93 295	7 603		7 603
22	129 931	38 598	168 529	12 136	3 605	15 741
23	318 114	38 598	356 712	33 853	4 108	37 961
24	647 378	77 196	724 575	78 067	9 309	87 377
25	722 697	385 982	1 108 679	98 263	52 481	150 744
26	218 447	192 991	411 438	33 335	29 450	62 785
27	29 126	308 785	337 912	4 967	52 659	57 626
28		77 196	77 196		14 654	14 654
29						
30						
TOTAL	12 621 743	20 379 841	33 001 584	461 016	347 420	808 436

## Annex IV continued

Mauritania, June 2003

### *Engraulis encrasicolus*

Length cm	N (thousands)			Biomass (tonnes)		
	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL
5						
6						
7		95 849	95 849		218	218
8		583 408	583 408		1 935	1 935
9		1 486 561	1 486 561		6 883	6 883
10	11 808	2 350 927	2 362 735	74	14 696	14 770
11	1 054 492	4 225 264	5 279 756	8 660	34 701	43 361
12	2 000 514	5 062 121	7 062 635	21 099	53 390	74 489
13	506 650	1 313 308	1 819 959	6 731	17 449	24 180
14	63 434	87 390	150 825	1 044	1 439	2 483
15						
16						
17						
18						
19						
20						
<b>TOTAL</b>	<b>3 636 898</b>	<b>15 204 829</b>	<b>18 841 728</b>	<b>37 609</b>	<b>130 709</b>	<b>168 318</b>

## Annex IV continued

Mauritania, June 2003

### *Trachurus trachurus*

Length cm	N (thousands)			Biomass (tonnes)		
	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL
5						
6						
7	2 163		2 163	9		9
8	34 610		34 610	204		204
9	123 353		123 353	1 015		1 015
10	1 240 841		1 240 841	13 790		13 790
11	444 821		444 821	6 495		6 495
12	30 034		30 034	563		563
13	10 011		10 011	236		236
14						
15						
TOTAL	1 885 833		1 885 833	22 312		22 312

### *Trachurus trecae*

Length cm	N (thousands)			Biomass (tonnes)		
	Cape Timiris- Cape Blanc	St. Louis- Cape Timiris	TOTAL	Cape Timiris Cape Blanc	St. Louis- Cape Timiris	TOTAL
5						
6		171 539	171 539		452	452
7		693 233	693 233		2 808	2 808
8		541 242	541 242		3 191	3 191
9		2 484 627	2 484 627		20 450	20 450
10		4 692 199	4 692 199		52 145	52 145
11	18 189	1 667 442	1 685 631	266	24 345	24 611
12	118 489	465 771	584 260	2 222	8 733	10 955
13	1 026 566	328 738	1 355 304	24 247	7 765	32 012
14	1 462 860	2 071 832	3 534 692	42 813	60 636	103 449
15	1 610 780	1 628 405	3 239 185	57 584	58 214	115 798
16	744 441	601 900	1 346 341	32 104	25 957	58 060
17	321 639	115 327	436 966	16 548	5 934	22 482
18	86 615	67 521	154 136	5 265	4 104	9 369
19		67 521	67 521		4 806	4 806
20						
TOTAL	5 389 579	15 597 297	20 986 876	181 048	279 541	460 589

## Annex V Regional estimates, May-July 2003

Sardine (*Sardina pilchardus*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6		4.8					4.8
7	162.2	84.8					247.0
8	1 731.9	394.0	11.4	220.7			2 358.1
9	1 694.8	1 048.5	295.5	6 377.5			9 416.3
10	208.1	1 105.2	848.3	8 255.1			10 416.6
11	7.9	3 638.6	2 133.0	3 876.2			9 655.6
12	35.6	5 541.1	3 226.4	531.0			9 334.0
13	336.0	3 969.2	1 391.8				5 697.1
14	1 709.6	1 880.8	983.4				4 573.7
15	5 896.3	291.4	1 132.9				7 320.7
16	8 222.0	46.8	414.6				8 683.4
17	3 754.7	418.4					4 173.1
18	1 493.6	2 098.9					3 592.5
19	1 334.4	2 877.7					4 212.1
20	450.6	12 510.9	25.5				12 987.0
21	59.1	16 102.0	93.3				16 254.4
22		11 533.1	129.9	38.6			11 701.6
23	68.9	8 714.6	318.1	38.6			9 140.3
24	84.3	6 013.1	647.4	77.2			6 821.9
25	7.7	2 048.6	722.7	386.0			3 164.9
26		473.5	218.4	193.0			884.9
27		36.1	29.1	308.8			374.0
28		3.2		77.2			80.4
29		1.5					1.5
30							
Total	27 257.5	80 836.9	12 621.7	20 379.8			141 096.0

Sardine (*Sardina pilchardus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6		11					11
7	561	293					855
8	8 722	1 984	58	1 111			11 875
9	11 915	7 372	2 077	44 837			66 201
10	1 975	10 491	8 052	78 362			98 880
11	99	45 377	26 601	48 340			120 417
12	570	88 743	51 673	8 504			149 490
13	6 778	80 080	28 081				114 939
14	42 737	47 017	24 583				114 337
15	180 050	8 899	34 594				223 543
16	302 859	1 725	15 273				319 857
17	165 006	18 388					183 394
18	77 545	108 974					186 519
19	81 136	174 970					256 106
20	31 830	883 823	1 800				917 453
21	4 815	1 312 230	7 603				1 324 648
22		1 077 228	12 136	3 605			1 092 969
23	7 336	927 400	33 853	4 108			972 696
24	10 160	725 117	78 067	9 309			822 654
25	1 041	278 543	98 263	52 481			430 329
26		72 251	33 335	29 450			135 036
27		6 153	4 967	52 659			63 779
28		603		14 654			15 256
29		310					310
30							
Total	935 135	5 877 983	461 016	347 420			7 621 555



## Annex V continued

Round sardinella (*Sardinella aurita*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11			225.3				225.3
12			1 305.2	12.5			1 317.7
13			2 409.3	8.3			2 417.6
14			864.1	4.2			868.3
15			765.2	4.2			769.4
16			211.0				211.0
17			82.2				82.2
18			8.9				8.9
19							
20							
21							
22						1.3	1.3
23		4.2		1.2		3.9	9.2
24		28.6		4.6		5.1	38.3
25		157.5		3.5		16.7	177.7
26		345.4		20.1	35.4	25.7	426.5
27		323.3		21.0	72.9	20.6	437.8
28		262.4		74.7	66.0	11.6	414.6
29		173.0		187.5	22.3		382.7
30		206.1		236.0	15.9		457.9
31		13.3		244.1	23.4		280.8
32		45.5		198.3	21.4		265.2
33		69.2		244.1	21.4		334.7
34		81.4		106.3	9.7		197.4
35		100.8		37.4	7.8		146.0
36		57.0		17.1	3.9		78.1
37		37.9		5.3	5.8		49.0
38		11.8		2.6	1.9		16.4
39		21.6			1.9		23.6
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		1 938.9	5 871.3	1 432.9	309.8	84.8	9 637.8

## Annex V continued

Round sardinella (*Sardinella aurita*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11			3 289				3 289
12			24 473	234			24 708
13			56 907	197			57 103
14			25 289	122			25 411
15			27 355	149			27 504
16			9 097				9 097
17			4 232				4 232
18			544				544
19							
20							
21							
22						140	140
23		514		144		480	1 138
24		3 952		651		726	5 328
25		24 552		550		2 659	27 761
26		60 416		3 593	6 316	4 591	74 915
27		63 202		4 187	14 561	4 104	86 055
28		57 090		16 599	14 661	2 570	90 920
29		41 740		46 214	5 488		93 441
30		54 964		64 278	4 321		123 563
31		3 910		73 248	7 014		84 172
32		14 682		65 345	7 061		87 088
33		24 453		88 102	7 734		120 288
34		31 408		41 904	3 840		77 152
35		42 391		16 084	3 347		61 821
36		26 077		8 002	1 819		35 898
37		18 791		2 674	2 958		24 424
38		6 336		1 447	1 067		8 850
39		12 516			1 153		13 669
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
<b>Total</b>		486 993	151 186	433 723	81 339	15 270	1 168 511

## Annex V continued

Flat sardinella (*Sardinella maderensis*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10						5.3	5.3
11			77.0			31.7	108.6
12			615.8			52.8	668.6
13			446.5			84.9	531.4
14			354.1			22.1	376.2
15			184.7			49.6	234.3
16			182.9			46.2	229.1
17			529.6			51.8	581.4
18			820.9			85.7	906.5
19			211.8	1.2		192.8	405.8
20			132.4	3.6		290.8	426.8
21			158.9	5.9		302.9	467.7
22			317.8	19.0		413.0	749.8
23			185.4	16.6		629.2	831.2
24			79.4	18.1	7.7	771.6	876.8
25				17.7	8.8	371.1	397.6
26				49.7	9.9	334.0	393.5
27		4.9		51.1	8.8	179.5	244.4
28		14.8		53.5	11.0	121.4	200.7
29		52.3		35.3	6.6	30.1	124.3
30		124.5		20.9	2.2	43.6	191.2
31		131.7		5.3	1.1	9.5	147.6
32		140.7		13.2		47.6	201.5
33		130.0		5.3		47.6	182.9
34		119.9		5.3		9.5	134.7
35		51.0				9.5	60.5
36		2.4				9.5	11.9
37							
38							
39							
40		0.2					0.2
41		0.2					0.2
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		772.7	4 297.2	321.6	56.2	4 243.2	9 690.9

## Annex V continued

Flat sardinella (*Sardinella maderensis*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10						59	59
11			1 124			462	1 586
12			11 546			989	12 536
13			10 545			2 006	12 551
14			10 363			648	11 011
15			6 604			1 772	8 376
16			7 887			1 992	9 880
17			27 248			2 666	29 914
18			49 897			5 206	55 103
19			15 080	85		13 725	28 890
20			10 950	295		24 053	35 298
21			15 159	567		28 896	44 621
22			34 747	2 080		45 163	81 990
23			23 094	2 073		78 386	103 553
24			11 215	2 554	1 089	108 928	123 786
25				2 817	1 403	59 068	63 288
26				8 871	1 771	59 664	70 307
27		998		10 204	1 760	35 839	48 801
28		3 334		11 887	2 448	26 969	44 638
29		13 034		8 691	1 629	7 424	30 778
30		34 273		5 684	600	11 883	52 439
31		39 928		1 585	331	2 857	44 700
32		46 854		4 352		15 689	66 896
33		47 419		1 907		17 182	66 508
34		47 766		2 083		3 753	53 602
35		22 125				4 089	26 215
36		1 142				4 445	5 587
37							
38							
39							
40		102					102
41		109					109
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		257 084	235 460	65 733	11 031	563 814	1 133 123

## Annex V continued

Anchovy (*Engraulis encrasicolus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5	124.7						124.7
6	407.3	1.6					408.9
7	333.9	46.2		95.8			475.9
8	354.1	101.3		583.4			1 038.8
9	258.8	44.1		1 486.6			1 789.4
10	206.8	16.0	11.8	2 350.9			2 585.5
11	401.5	2.2	1 054.5	4 225.3			5 683.4
12	880.6	1.7	2 000.5	5 062.1			7 945.0
13	1 190.9	0.4	506.7	1 313.3			3 011.3
14	523.7	0.4	63.4	87.4			675.0
15	95.3						95.3
16	5.0						5.0
17							
18							
19							
20							
Total	4 782.6	213.9	3 636.9	15 204.8			23 838.2

Anchovy (*Engraulis encrasicolus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5	112						112
6	604	2					606
7	761	105		218			1 084
8	1 174	336		1 935			3 445
9	1 198	204		6 883			8 285
10	1 293	100	74	14 696			16 162
11	3 297	18	8 660	34 701			46 676
12	9 288	18	21 099	53 390			83 795
13	15 822	6	6 731	17 449			40 008
14	8 621	7	1 044	1 439			11 111
15	1 916						1 916
16	122						122
17							
18							
19							
20							
Total	44 208	796	37 609	130 709			213 323

## Annex V continued

Atlantic horse mackerel (*Trachurus trachurus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7			2.2				2.2
8	22.7		34.6				57.3
9	79.4		123.4				202.8
10	17.0		1 240.8				1 257.9
11		2.9	444.8				447.8
12	1.1	5.9	30.0				37.1
13		19.1	10.0				29.1
14		29.9					29.9
15		136.1					136.1
16		293.7					293.7
17		502.2					502.2
18		1 018.6					1 018.6
19		1 078.3					1 078.3
20		607.8					607.8
21		144.4					144.4
22		38.0					38.0
23		14.8					14.8
24		7.8					7.8
25		45.6					45.6
26		72.4					72.4
27		72.3					72.3
28		36.7					36.7
29		38.5					38.5
30		29.8					29.8
31		31.4					31.4
32		27.9					27.9
33	1.7	22.7					24.4
34							
35	3.8						3.8
36	2.1						2.1
37	1.7						1.7
38	5.4						5.4
39	2.7						2.7
40	24.9						24.9
41	4.9						4.9
42	9.0						9.0
43	12.3						12.3
44	1.8						1.8
45							
46							
47							
48							
49							
50							
Total	190.5	4 277.0	1 885.8				6 353.3

## Annex V continued

Atlantic horse mackerel (*Trachurus trachurus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7				9			9
8	117		204				321
9	572		1 015				1 587
10	166		13 790				13 955
11		38	6 495				6 532
12	19	97	563				678
13		395	236				632
14		764					764
15		4 256					4 256
16		11 083					11 083
17		22 609					22 609
18		54 177					54 177
19		67 165					67 165
20		43 985					43 985
21		12 052					12 052
22		3 635					3 635
23		1 617					1 617
24		961					961
25		6 354					6 354
26		11 315					11 315
27		12 636					12 636
28		7 146					7 146
29		8 311					8 311
30		7 101					7 101
31		8 255					8 255
32		8 043					8 043
33	544	7 167					7 710
34							
35	1 428						1 428
36	849						849
37	762						762
38	2 578						2 578
39	1 373						1 373
40	13 885						13 885
41	2 970						2 970
42	5 779						5 779
43	8 478						8 478
44	1 325						1 325
45							
46							
47							
48							
49							
50							
<b>Total</b>	<b>40 845</b>	<b>299 163</b>	<b>22 312</b>				<b>362 320</b>

## Annex V continued

Cunene horse mackerel (*Trachurus trecae*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						0.9	0.9
5						0.4	0.4
6				171.5		2.5	174.0
7				693.2	4.4	16.1	713.7
8				541.2	21.4	44.8	607.5
9				2 484.6	75.2	39.9	2 599.8
10		17.9		4 692.2	95.8	34.2	4 840.1
11		170.2	18.2	1 667.4	85.3	24.6	1 965.6
12		454.1	118.5	465.8	21.7	83.4	1 143.5
13		1 603.5	1 026.6	328.7	4.2	9.5	2 972.5
14		1 889.7	1 462.9	2 071.8		1.5	5 425.9
15		1 458.3	1 610.8	1 628.4		1.5	4 699.0
16		620.9	744.4	601.9		2.2	1 969.5
17		242.7	321.6	115.3	8.4	4.2	692.3
18		57.6	86.6	67.5	25.7	49.7	287.1
19		11.5		67.5	74.7	162.8	316.5
20		19.1			139.3	242.4	400.9
21		3.1			118.5	147.0	268.6
22					75.0	169.5	244.4
23		8.0			22.3	65.1	95.4
24		24.2			3.7	9.3	37.2
25		61.3					61.3
26		60.3					60.3
27		36.0					36.0
28		7.9					7.9
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		6 746.4	5 389.6	15 597.3	775.6	1 111.4	29 620.3



## Annex V continued

Cunene horse mackerel (*Trachurus trecae* ), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						1	1
5						1	1
6				452		6	459
7				2 808	18	65	2 891
8				3 191	126	264	3 581
9				20 450	619	329	21 398
10		174		52 145	1 065	380	53 764
11		2 174	266	24 345	1 245	359	28 389
12		7 450	2 222	8 733	407	1 564	20 376
13		33 141	24 247	7 765	98	224	65 475
14		48 391	42 813	60 636		44	151 884
15		45 617	57 584	58 214		54	161 469
16		23 430	32 104	25 957		95	81 585
17		10 926	16 548	5 934	434	214	34 055
18		3 065	5 265	4 104	1 562	3 019	17 015
19		716		4 806	5 321	11 588	22 431
20		1 384			11 525	20 052	32 960
21		255			11 311	14 023	25 588
22					8 199	18 530	26 729
23		876			2 776	8 112	11 764
24		2 994			524	1 313	4 831
25		8 539					8 539
26		9 424					9 424
27		6 285					6 285
28		1 545					1 545
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		206 385	181 048	279 541	45 228	80 237	792 438

## Annex V continued

False scad (*Caranx rhonchus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						4.5	4.5
5						118.0	118.0
6						82.2	82.2
7						56.8	56.8
8						63.9	63.9
9						49.0	49.0
10						19.3	19.3
11						39.3	39.3
12						72.4	72.4
13						7.8	7.8
14						1.3	1.3
15						1.3	1.3
16						1.3	1.3
17							
18							
19							
20						5.2	5.2
21						16.0	16.0
22					3.2	43.9	47.1
23					1.6	44.7	46.3
24					1.6	12.0	13.7
25					1.6	21.5	23.1
26					6.4	7.7	14.1
27					19.3	5.1	24.4
28					11.3	0.7	12.0
29					9.6	5.1	14.7
30					4.9	8.6	13.5
31					5.8	13.0	18.8
32					3.3	17.3	20.6
33					5.9	8.6	14.5
34					2.5	4.3	6.8
35					3.3	4.3	7.7
36					1.7	4.3	6.0
37					0.8		0.8
38					1.7		1.7
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total					84.6	739.6	824.2

## Annex V continued

False scad (*Caranx rhonchus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						4	4
5						189	189
6						217	217
7						230	230
8						362	362
9						392	392
10						171	171
11						270	270
12						17	17
13							
14							
15							
16							
17							
18							
19							
20						431	431
21						1 527	1 527
22					352	4 803	5 155
23					200	5 571	5 771
24					227	1 700	1 927
25					256	3 426	3 682
26					1 149	1 369	2 519
27					3 853	1 011	4 864
28					2 502	164	2 666
29					2 378	1 248	3 626
30					1 332	2 356	3 688
31					1 738	3 893	5 631
32					1 103	5 701	6 803
33					2 114	3 122	5 235
34					989	1 705	2 694
35					1 437	1 857	3 295
36					781	2 019	2 800
37					424		424
38					917		917
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total					21 751	43 752	65 503

## Annex V continued

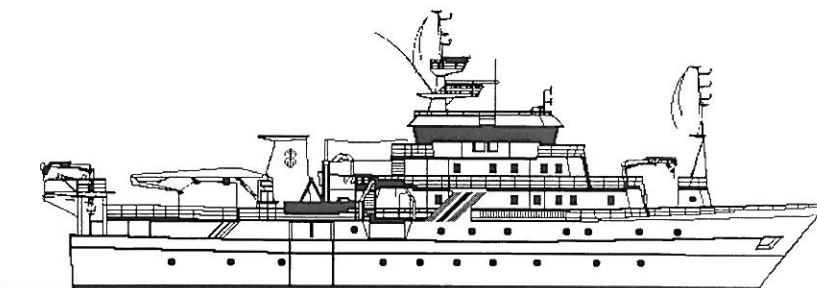
Chub mackerel (*Scomber japonicus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11		63.2					63.2
12		11.0					11.0
13	42.0	15.3					57.4
14	497.1	101.6					598.7
15	231.0	216.7					447.8
16	21.0	223.6					244.6
17	0.8	97.7					98.5
18		44.3					44.3
19		32.8					32.8
20	5.9	54.1					60.0
21	16.8	91.3					108.1
22	29.2	123.9					153.0
23	61.0	165.0					226.0
24	43.8	182.2					226.0
25	5.1	109.0					114.2
26	14.5	103.4					117.8
27	4.9	180.5					185.4
28		277.2					277.2
29	1.0	147.6					148.5
30	0.5	117.2					117.6
31	11.8	47.9					59.7
32	13.9	38.6					52.5
33	9.9	28.8					38.7
34	2.0	11.0					13.0
35	4.0	9.7					13.7
36		1.8					1.8
37		6.9					6.9
38							
39		2.7					2.7
40		0.1					0.1
41		3.3					3.3
42		3.2					3.2
43		0.1					0.1
44		0.3					0.3
45		0.3					0.3
46		0.3					0.3
47		0.2					0.2
48		0.1					0.1
49		0.1					0.1
50		0.1					0.1
Total	1 016.0	2 513.1					3 529.1

## Annex V continued

Chub mackerel (*Scomber japonicus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11		807					807
12		181					181
13	868	317					1 185
14	12 729	2 603					15 332
15	7 227	6 780					14 007
16	793	8 436					9 229
17	36	4 400					4 436
18		2 357					2 357
19		2 041					2 041
20	427	3 915					4 342
21	1 402	7 622					9 024
22	2 789	11 851					14 640
23	6 651	17 990					24 641
24	5 405	22 512					27 917
25	716	15 185					15 902
26	2 263	16 159					18 422
27	851	31 534					32 385
28		53 903					53 903
29	207	31 825					32 032
30	114	27 925					28 039
31	3 110	12 564					15 674
32	4 000	11 132					15 132
33	3 115	9 100					12 215
34	684	3 788					4 471
35	1 489	3 660					5 149
36		754					754
37		3 078					3 078
38							
39		1 385					1 385
40		32					32
41		1 979					1 979
42		2 055					2 055
43		40					40
44		213					213
45		273					273
46		243					243
47		207					207
48		55					55
49		117					117
50		62					62
Total	54 877	319 079					373 956



**SURVEY OF THE PELAGIC FISH RESOURCES  
OFF NORTH WEST AFRICA**

**Part III**

**MOROCCO**

**18 May – 16 June 2003**

CRUISE REPORT "DR FRIDTJOF NANSEN"

**SURVEY OF THE PELAGIC FISH RESOURCES  
NORTH WEST AFRICA**

**Part III**

**MOROCCO**

**18 May-16 June 2003**

by

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Bergen, 2003**

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## CHAPTER 1 INTRODUCTION

---

### 1.1 Survey objectives

The specific objectives for the survey in Morocco were:

- To map the distribution and estimate the biomass of the main small pelagic fish species using hydroacoustic methods. The species of interest were: sardine *Sardina pilchardus*, sardinellas *Sardinella aurita*, *S. maderensis*, chub mackerel *Scomber japonicus*, horse mackerel *Trachurus trachurus*, *T. trecae*, and anchovy *Engraulis encrasicolus*.
- To identify acoustic targets by midwater and bottom trawl sampling and process the catches by recording weight and number by species. For the target species, length frequencies are taken to describe the size distribution.
- To collect otoliths of sardine, sardinella and anchovy for later reading ashore.
- To sample standard hydrographical transects for temperature, salinity and oxygen off Cape Blanc, Cape Barbas, Dakhla, Cape Bojador, Cape Juby, Cape Dra and Cape Ghir.

The time allocated for this part of the survey was 25 working days.

### 1.2 Participation

Members of the scientific teams were:

Institut National de Recherche Halieutique, Morocco:

Hamid CHFIRI (team leader 18.05-02.06), Mostafa CHBANI (02-16.06), Lahcen ABOUABDELLAH, Mohamed ARAABAB, Ahmed El YOUSSEFI, Hicham GOURICH and Najib CHAROUKI.

Institut Mauritanien de Recherches Océanographiques et des Pêches, Mauritania:

Saikou Oumar KIDE.

Institute of Marine Research, Norway (IMR):

Oddgeir ALVHEIM (cruise leader 18 May-2 June), Tore STRØMME (cruise leader 2-16 June), Marek OSTROWSKI (2-16 June), Tore MØRK and Thor Egil JOHANSSON.

### 1.3 Narrative

Figure 1 shows the cruise track and the stations worked during the survey. The vessel departed Agadir on May 18, steaming northwards to Cape Cantin from where the sampling work started. The survey proceeded southwards with an acoustic sampling grid with a transect distance 10 nautical miles (NM) apart, covering the shelf and slope down until about 200 m bottom depth. The outer shelf between Cape Dra and Cape Juby was sampled with a more open grid as it is known from previous surveys that this part of the shelf holds few pelagic resources and no sardine. The survey continued to south of Cape Bojador when sampling was interrupted with a call at Las Palmas 1-3 June for refuelling and change of crew. The survey proceeded southwards covering the shelf between Cape Bojador and Cape Blanc with transects. Due to fine weather and well defined fish distributions it was not necessary to resurvey part of the area as often in the past. The survey reached Cape Blanc on the morning of 14 June. As time allowed and in order to have a synoptic registration acoustic mapping of pelagic fish was continued southwards in transects until out of the main concentrations, off Cape Timiris. The survey ended on 16 June with a call at Nouakchott for disembarkment of scientific team.

The weather was more calm than normal during the survey and did not put any constraints on the survey work.

### 1.4 Methods

The cruise followed the standard methods established for the regional surveys.

#### *Environmental data*

Meteorological observations including wind direction and speed, air temperature, global radiation and sea surface temperature (SST) were automatically logged and recorded with position and bottom depth every nautical mile sailed using an Aanderaa meteorological station. CTD-stations were recorded at the standard hydrographic transects. A Seabird 911+ CTD probe was used to obtain vertical profiles of temperature, salinity and oxygen. Real time plotting and logging was done using the customised Seabird Seasave software installed on a PC. The profiles were in general taken down to a few meters above the bottom. In deep stations, however, data logging was interrupted at 500 m. Niskin bottles were triggered for water samples, one near the surface and one near the bottom, in order to calibrate the oxygen and salinity sensors. The water samples were analysed for dissolved oxygen using the Winkler method, and for salinity using a Guildline Portasal salinometer mod. 8410.

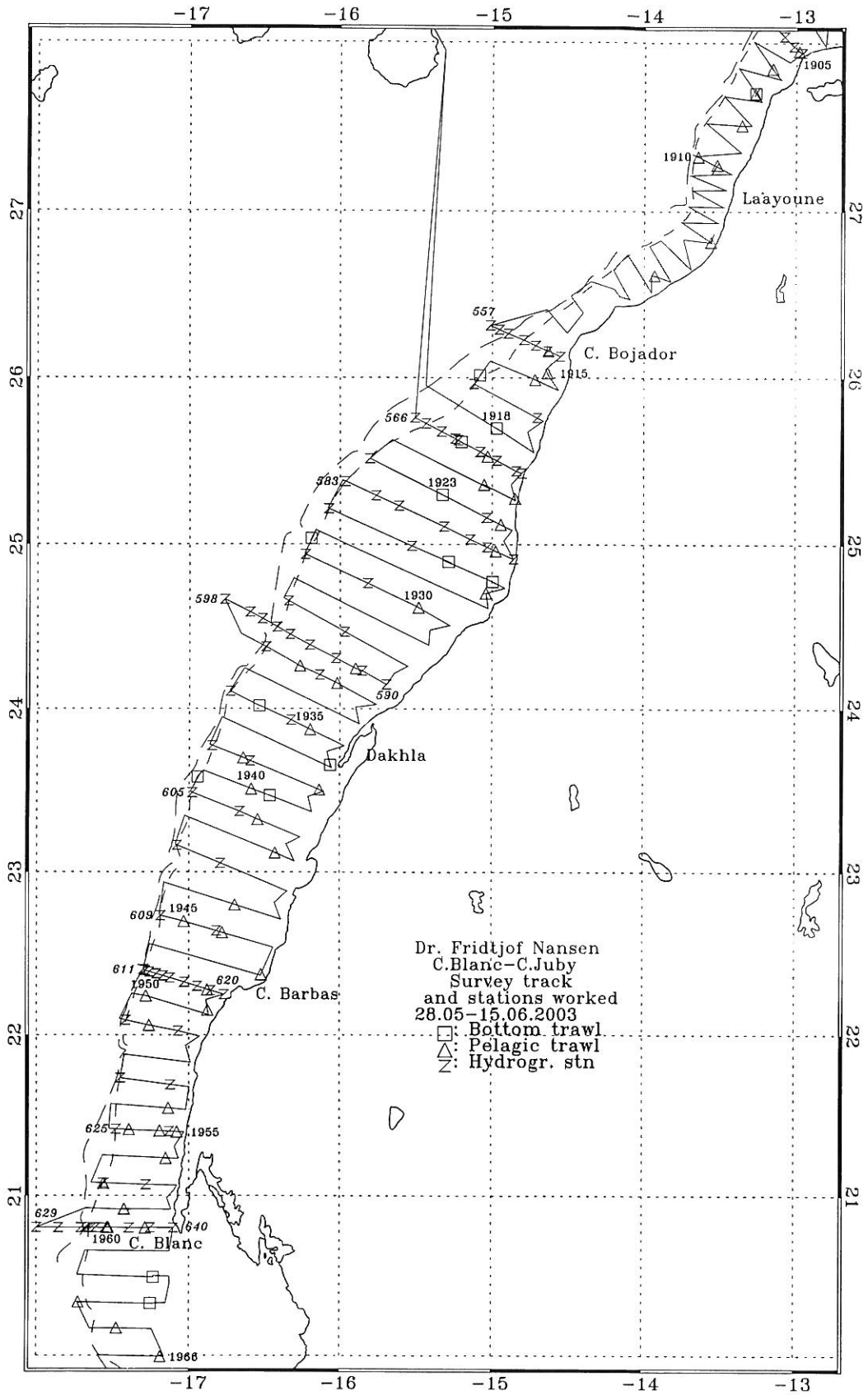


Figure 1a. Course track with fishing and hydrographic stations, Cape Blanc to Cape Juby. Depth contours at 20 m, 50 m, 100 m, 200 m and 500 m are indicated.

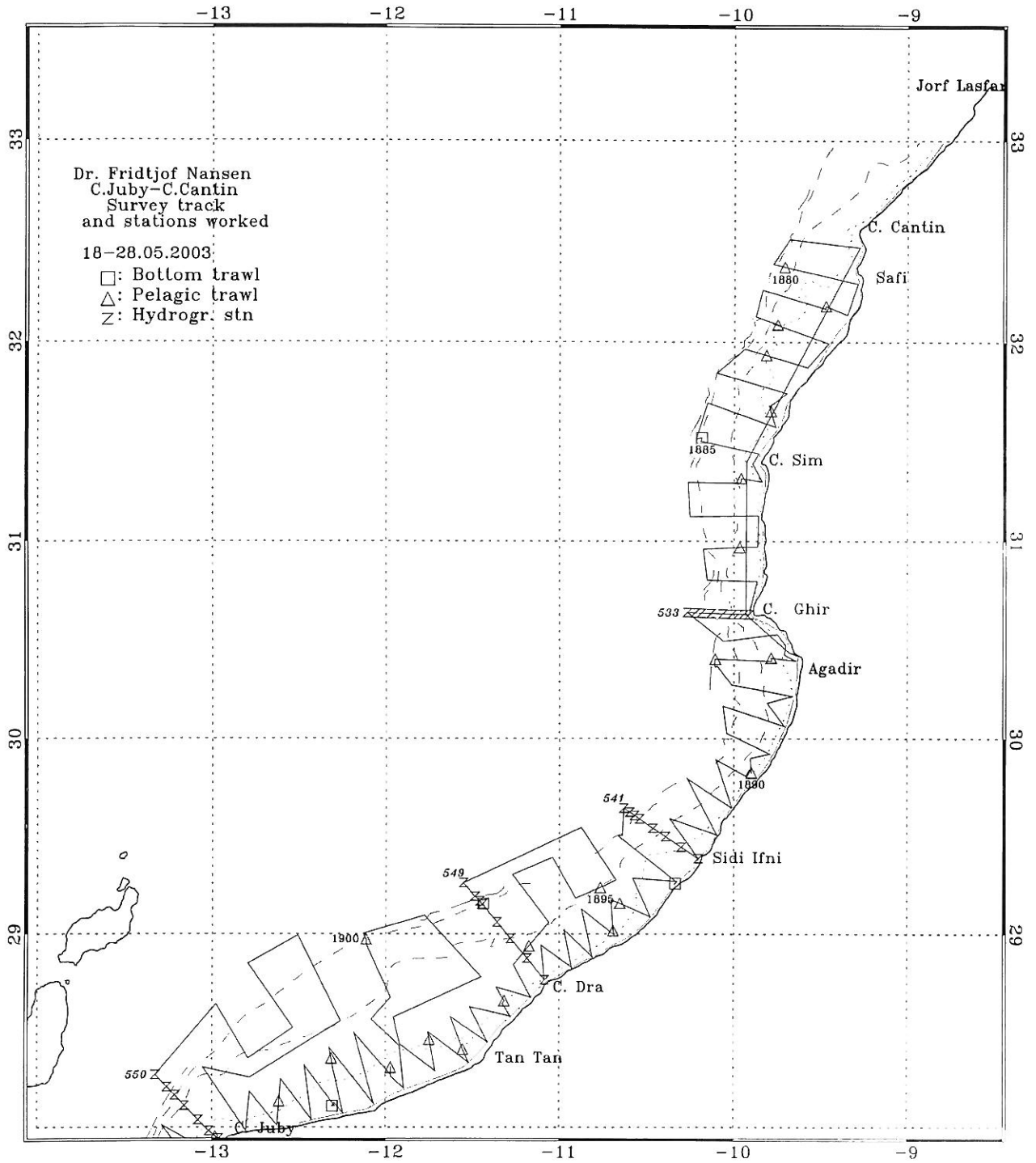


Figure 1b. Course track with fishing and hydrographic stations, Cape Juby to Cape Cantin. Depth contours as in Fig. 1a.

### *Biological sampling*

Biological sampling of the fish was carried out using trawls. A pelagic trawl with floats was often used. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). Annex III gives a description of the instruments and the fishing gear used. All catches were sampled for composition by weight and numbers of each species caught. Species identification was based on the FAO Species Guides. Length frequency distributions, by total fish length in cm, of the selected target species were taken in all the stations where they were present. The complete records of fishing stations are shown in Annex II.

The following target groups were used for Morocco:

1. Sardine (European pilchard *Sardina pilchardus*),
2. Sardinellas (flat sardinella *Sardinella maderensis* and round sardinella *S. aurita*),
3. Anchovy (European anchovy *Engraulis encrasicolus*),
4. Horse mackerels (Atlantic horse mackerel *Trachurus trachurus*, Cunene horse mackerel *T. trecae*,
5. Mackerels (chub mackerel *Scomber japonicus*),
6. Other pelagic scombrids, carangids and associated species (such as *Auxis* sp., *Caranx* sp. and largehead hairtail *Trichiurus lepturus*), BEI group PEL2,
7. Other demersal species (such as Sparidae, Haemulidae and Merlucciidae).

Otoliths of anchovy, sardine, sardinella, horse mackerel and chub mackerel were collected for a regional project on aging.

### *Acoustic sampling*

A SIMRAD EK500 Echosounder was used and the echograms were stored on both paper and files. The acoustic biomass estimates were based on the integration technique. The Bergen Integrator (BEI) was used for analysis and allocation of the integrated  $s_A$ -values (average area back scattering coefficient in  $m^2/NM^2$ ) to the individual specified target groups by 5 NM intervals. The BEI system has improved capabilities in discriminating dense fish aggregations close to the bottom as compared to the inbuilt integrator in EK500, which was used in the surveys prior to 1995. The splitting and allocation of the integrator outputs ( $s_A$ -values) was based on a combination of a visual scrutiny of species characteristics as deduced from echo diagrams, the BEI analysis, and the catch compositions.

In cases where the target category of fish contains more than one species (sardinellas and horse mackerels), the mean  $s_A$ -value allocated to the category is divided between the species in the same ratio as their relative contribution to the mean back scattering strength in the length frequency samples.

The following target strength (TS) function was applied to convert allocated  $s_A$ -values (average integrator value, or area back scattering coefficient for a given species or group of species in a specified area) to number of fish:

$$TS = 20 \log L - 72 \text{ dB} \quad (1)$$

which can be converted (see Toresen *et al.* 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26 \cdot 10^6 \cdot L_i^{-2} \quad (2)$$

where  $L_i$  is total length in 1 cm length group  $i$  and  $C_{Fi}$  ( $m^{-2}$ ) is the reciprocal back scattering cross section, or so-called fish conversion factor. In order to split and convert the allocated  $s_A$ -values ( $m^2/NM^2$ ) to fish densities (numbers per length group per  $NM^2$ ), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^n \frac{p_i}{C_{Fi}}} \quad (3)$$

where  $\rho_i$  = density ( $n/NM^2$ ) of fish in length group  $i$   
 $s_A$  = mean integrator value ( $m^2/NM^2$ )  
 $p_i$  = proportion of fish in length group  $i$   
 $\sum_{i=1}^n \frac{p_i}{C_{Fi}}$  = the relative back scattering cross section ( $m^2$ ) of the length frequency sample of the target species, and

$C_{Fi}$  = reciprocal back scattering cross section ( $\sigma_{bs}^{-1}$ ) of a fish in length group  $i$

For  $TS = 20 \log L - 72$  the formula can further simplified into:

$$\rho_i = 1261217 \cdot \frac{n_i}{s_a \sum_{i=\min}^{\max} n_i l_i^2} \quad (4)$$

where  $s_A$  = mean integrator value of a species within an aggregation area, in  $m^2/NM^2$   
 $n_i$  = frequency count of length group  $i$  in a pooled representative sample from the distribution area.

$l_i$  = mid length of fish in length group  $i$ .

The constant 1261217 incorporates the offset constant -72 in equation (1). For other TS relationships the equation constant becomes as in box. The table is presented to facilitate a recalculation in case more accurate TS measurements are provided in the future:

TS constant	Equation Constant
-74	1998895
-73	1587779
-72	1261217
-71	1001821
-70	795774
-69	632106
-68	502099

Using equation (4), the pooled length distribution is used together with the mean  $s_A$ -value to calculate the density by length groups for each observed area with fish aggregations. The total number, by length groups, in an area is obtained by multiplying the densities with the distribution area. Areas were calculated on the maps by using a digital planimeter (Tamaya Planix 7).

The number of fish were converted to biomass by length group using the estimated weight at length from the length-weight relationship:

$$\bar{w} = \frac{cond}{100} * L^3 \quad (3)$$

The specific condition factors obtained from the samples and applied for this survey were: 0.82 for sardine, 0.94 for *S. aurita*, 0.97 for *S. maderensis*, 0.54 for *Engraulis encrasicolus* and 0.84 for horse mackerel and chub mackerel.

Finally the total biomass estimate is obtained by summing the biomass by length group and areas within each sector of the survey.

Equations (1), (2) and (3) show that the conversion from  $s_A$ -value to number of fish is dependent on the length composition of the fish. In general there are many problems associated with getting representative length distributions when the various size classes mix with varying proportions between neighbouring stations. When the size classes are well and homogeneously mixed in an area, the various length distributions are pooled together with equal importance. In areas where fish size-groups are well segregated, separate estimates are made for each group. Otherwise, when the size distribution varies from sample to sample, a weighting factor is applied that takes into account the density at the location. In most cases, the mean acoustic density at the location of the sample is the most representative index of this fish density.

For the estimation of the biomass of target group 6, carangids and associated species, an overall average length of 23 cm and a condition factor of 0.88 (to calculate mean weight of this length group) were applied.

A systematic approach to a) produce pooled length distributions of a target species for use in the above equation and b) calculate the biomass estimates for a region, are obtained through the following procedure:

- Each trawl station gets an integrator value as a density index for the sampling site.
- Representative length distributions are selected from all the collected samples of a fish aggregation.
- The mean back scattering strength of a fish in each of these length frequency distributions is calculated.
- The selected length distributions are then pooled using the ratio between the allocated  $s_A$ -value and the mean back scattering strength as the weighting factor. (If the size distribution is geographically uniform the three steps mentioned above can be skipped and the samples are pooled together with equal importance.)
- The pooled length distribution is used together with the mean  $s_A$  value to calculate the biomass in numbers by length groups, for each area in the map, using formula (4) above. Numbers are converted to weight using the condition factor of the species. This can be calculated from the length samples where the total weight of the sample is recorded, or from individual biological samples.
- Biomass is calculated as the product of the density and the area of the aggregation, and finally the area-related biomass values in a region are summed together.

The necessary calculations are done in spreadsheets after the scientist has completed the two first steps in the above list manually.

All data on fishing stations and fish length sampling were made available to the participants from the local research institutes on CDs.



## CHAPTER 2 SURVEY RESULTS

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### 2.1 Hydrographic conditions

#### *Wind conditions*

Weak-to-moderate winds characterized the weather conditions during this survey. The distribution of winds along the survey track is represented in Figure 2. The predominant wind direction is for the entire region is north-east. This resembles the seasonal wind pattern for June, whereby the subtropical trade wind belt reaches the northern extremity of its annual range. Due to this wind direction and the predominant direction of the coastline, the main wind stress is during this period is oriented alongshore and favours development of upwelling along the most of the coastline.

The strongest wind events were observed between Cape Cantin and Cape Ghir, between Tan-Tan and Cape Juby in the north (Figure 2b); and off Cape Blanc in the south (Figure 2a). The wind velocity during these events was 10 m/s on average and reached 16 m/s during gusts. The low-wind conditions, characterized by the speed below 5 m/s, were observed off Sidi-Ifni (Figure 2b), Laayoune, and south of Cape Barbas (Figure 2a).

The wind conditions during this survey were considerably calmer from those observed from the previous surveys, which were conducted in the same period during the past two years.

#### *Sea surface temperature*

The distributions of sea surface temperature (SST) are depicted Figure 3. They present a strong evidence of intense upwelling conditions during the time of this survey. The temperature on the outer shelf was warmer than usual, often exceeding 20 °C, while the inshore temperatures associated to upwelling cells were at the usual level below 17 °C. Due to such a contrast, the upwelling cells were easily identifiable from the distributions of SST. The most pronounced upwelling cell in the north was observed off Cape Sim, where the temperature was less than 16 °C (Figure 3b). The other upwelling cells in that region were observed off Sidi Ifni, Cape Dra and Cape Juby. It must be remarked, however, that at those locations, as opposed to Cape Sim, the wind conditions during the ship's passage were either calm or not upwelling-favourable.

In the southern region (Figure 3a), three upwelling cells were observed. These were: Lacraa (latitude 25°N), Dakhla and Cape Blanc. The warmest surface temperature was observed at the usual location, off Cape Bojador, in the locality situated along the steep section of the shelf and

where warm and saline water masses associated to the Canary Current reach their closest distance to the Moroccan coastline.

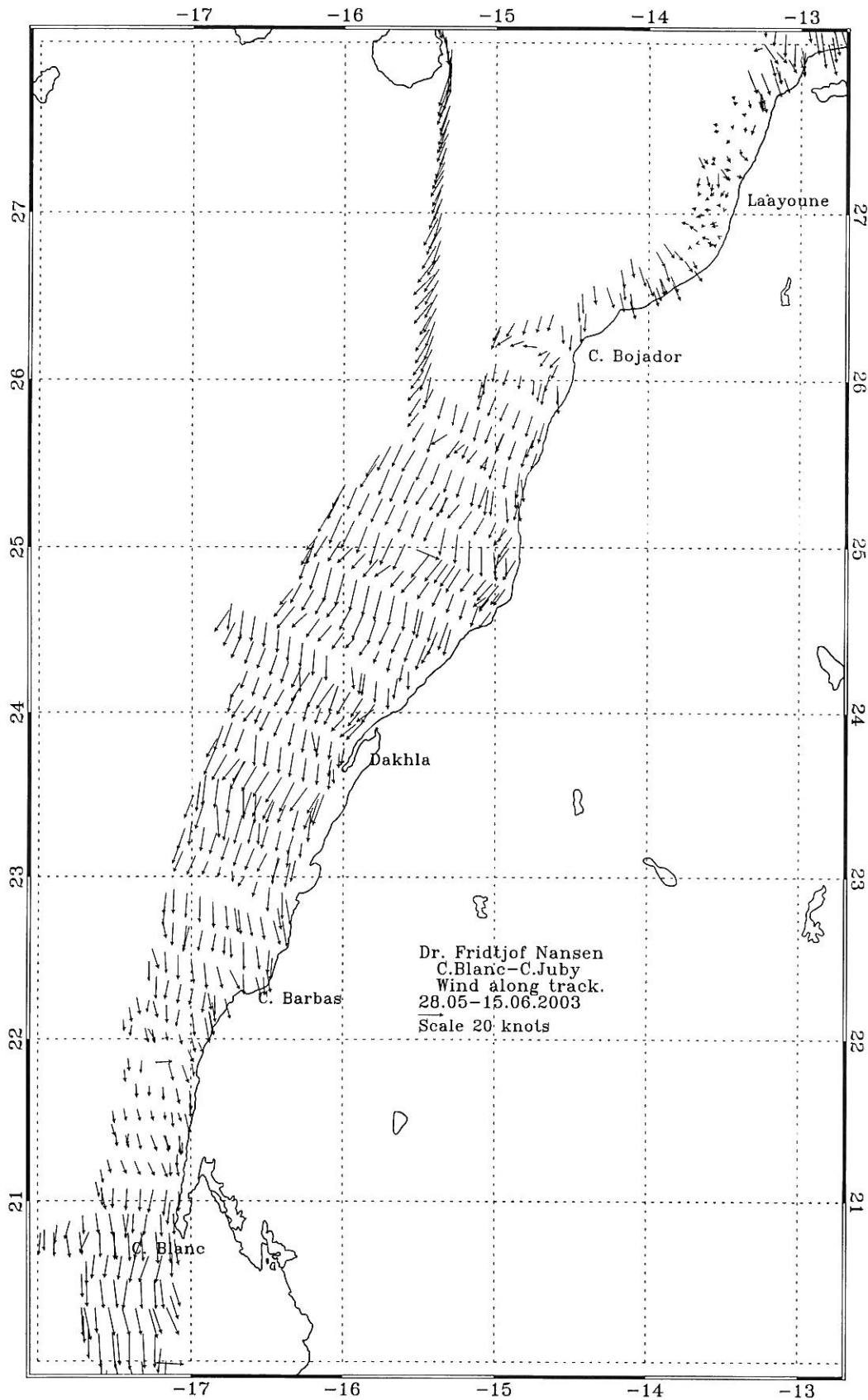


Figure 2a. Wind conditions along the survey, Cape Blanc to Cape Juby. Depth contours as in Fig. 1a.

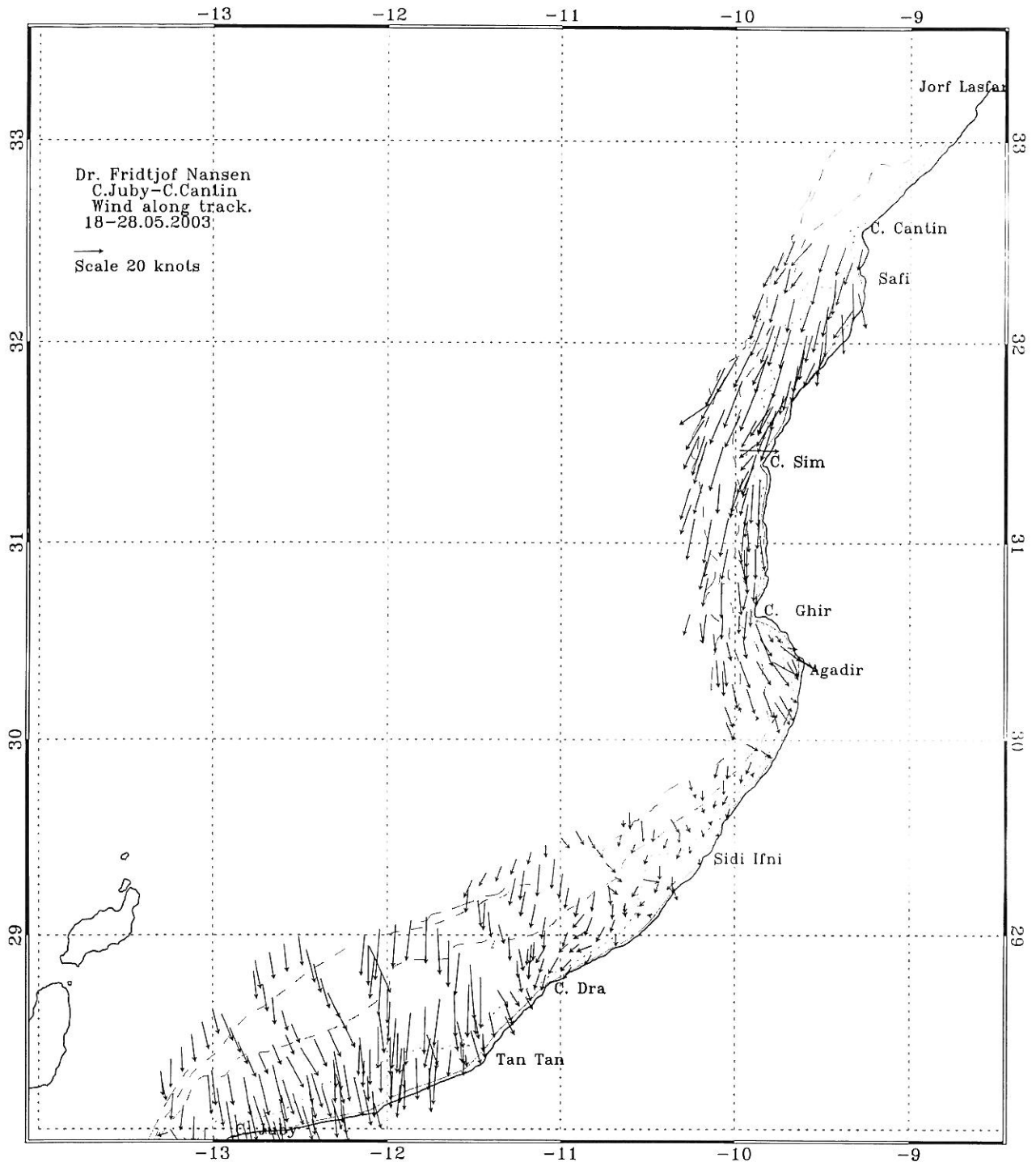


Figure 2b. Wind conditions along the survey, Cape Juby to Cape Cantin. Depth contours as in Fig. 1a.

#### *Vertical stratification and water masses*

The hydrographic sections are depicted in Figure 4. Their respective locations are given in Figure 1. The figures indicate a clear separation between the two major hydrographic regimes of the region: the North and South Atlantic water masses. The North Atlantic regime, is dominant to the north of Cape Bojador, while that influenced by the South Atlantic to the south of it. During the survey, to the north of Cape Bojador, the water column was dominated by a

high-salinity, subsurface core located in the vicinity of the shelf-break. As the survey progressed from the north to the south, the salinity at the core rose from  $S > 36.2$  (Cape Ghir) to  $S > 36.7$  (Cape Bojador). In spite of this change, the core's position relative to the shelf-break remained constant at all sections located to the north of Cape Bojador. To the south of Cape Bojador the pattern had changed. At Dakhla, the core became detached from the shelf-break and repositioned offshore. Further south, it disappeared completely from the area covered by the survey.

From examining Figure 4, it is evident that the warm and saline surface water masses on the outer shelf were associated with the high-salinity core of the North Atlantic origin. Underlying it on the shelf, were the subsurface water layers, drawn at the shelf-break and transported towards the coast by upwelling. From Figure 4, it is also evident that the properties of the upwelled seawater varied greatly between the sections located to the north and south of Cape Bojador, in particular, with respect to oxygen. In the north, the oxygen concentrations at the shelf-break and in the upwelled water were high, 4-5 ml/l. In the south, the respective concentrations were much lower, below 2 ml/l. The section plots indicate that the transition zone between these two regimes occurred between Dakhla and Cape Barbas.

Figure 5 depicts the extent of the two Atlantic regimes along the two depth contours 50 and 200 m depth in the region between Cape Bojador and Cape Blanc. The water of the South Atlantic origin is marked in that figure by the salinity  $< 36$  and the oxygen concentration  $< 3$  ml/l, whereas that of the North Atlantic origin by the higher values. On the shelf (Figure 5a), the North Atlantic regime dominates the whole water column, with the South Atlantic water masses confined only to the vicinity of Cape Blanc. Further offshore, in the shelf-break region, (Figure 5b) the North Atlantic water occupies the upper part of the water column while the core the South Atlantic water mass descends along the continental slope below the lighter North Atlantic waters and reaches the depth of 200 m approximately at the position of the Dakhla section.

### *Summary*

Warm air temperatures and weak-to-moderate, upwelling-favourable winds characterized the weather conditions observed during this survey. Active upwelling cells were observed along the whole coastline from Cape Cantin to Cape Blanc. The North Atlantic water masses dominated the hydrographic conditions along the entire shelf. These calmer conditions and the associated increase in solar radiation, in the presence of active upwelling cells may have created good grazing conditions for small pelagic fish to form dense concentrations in the inner part of the shelf.

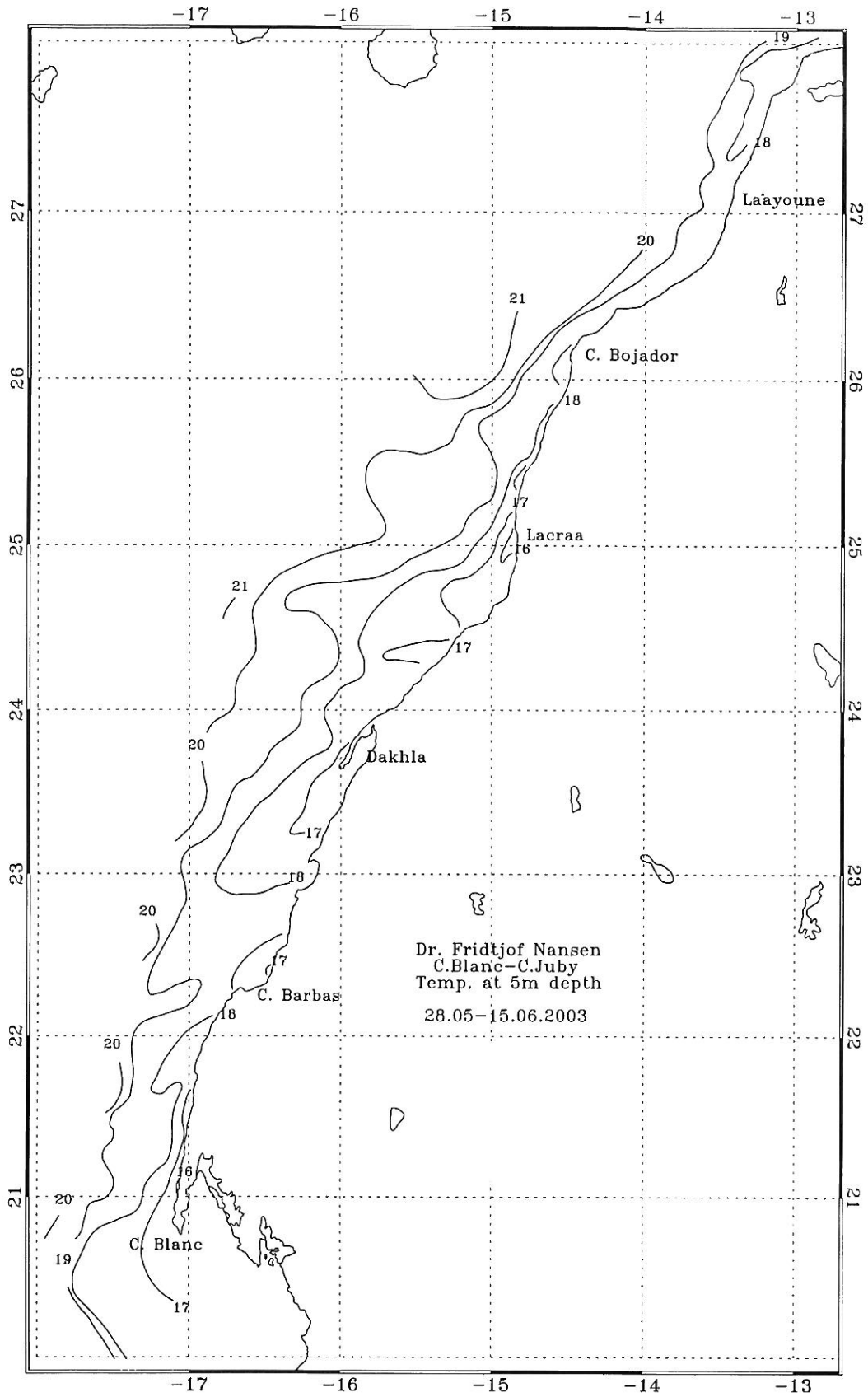


Figure 3a. Sea surface temperature (at 5 m depth), Cape Blanc to Cape Juby. Depth contours as in Fig. 1a.

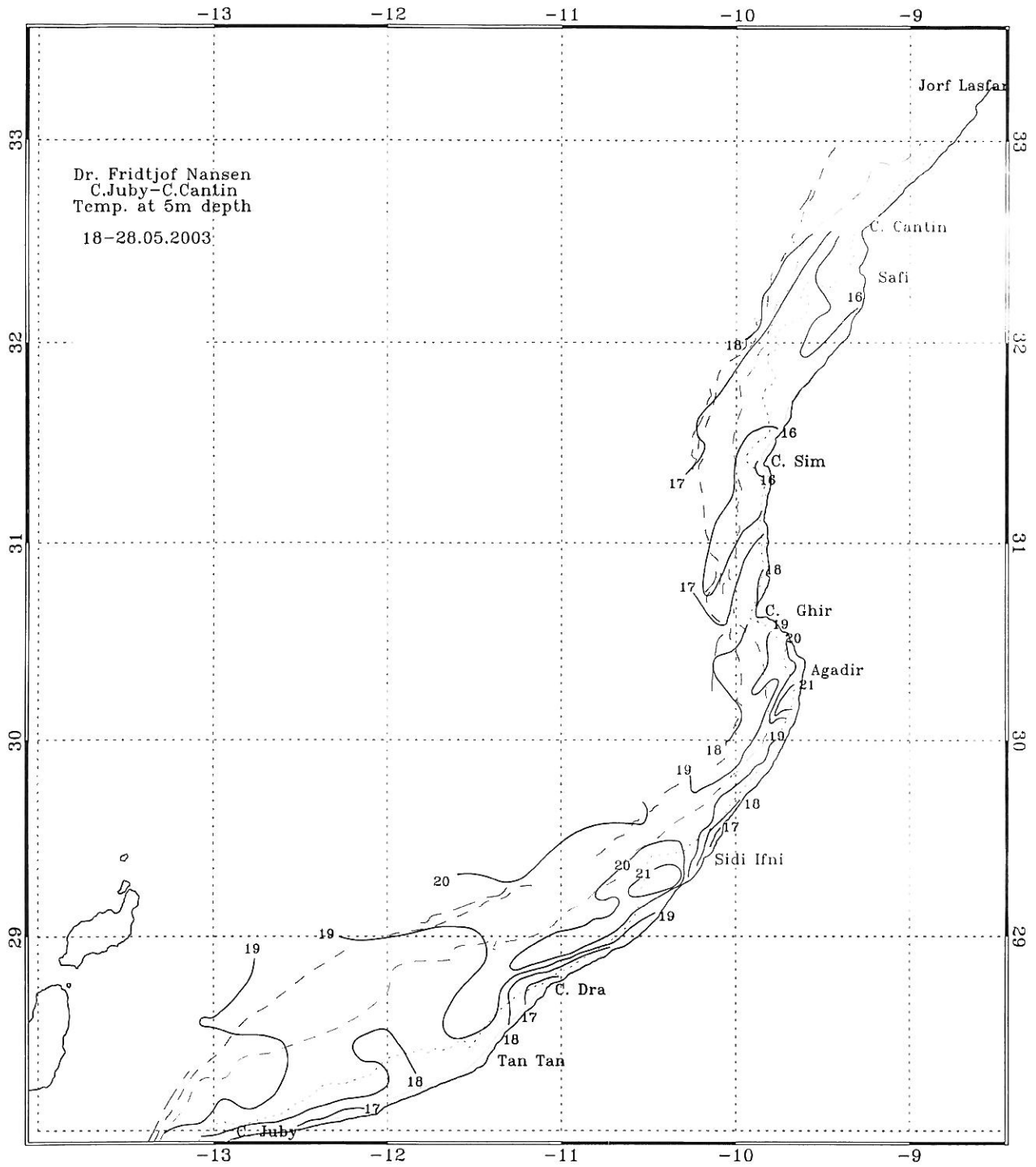
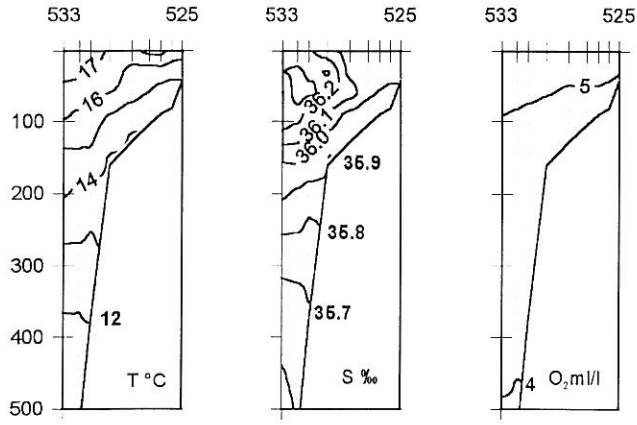
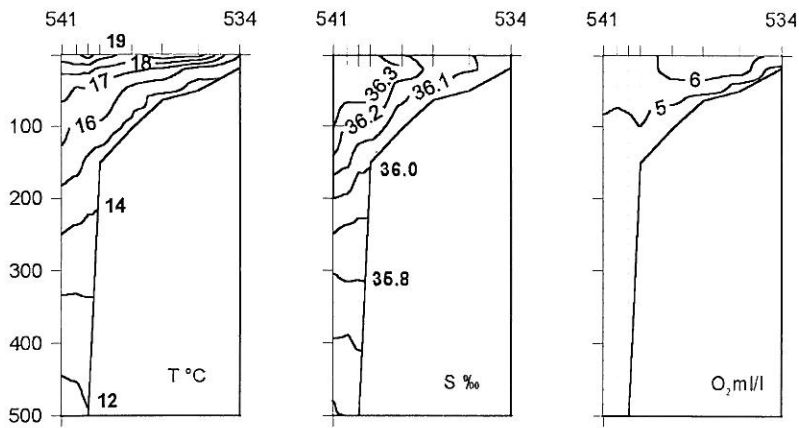


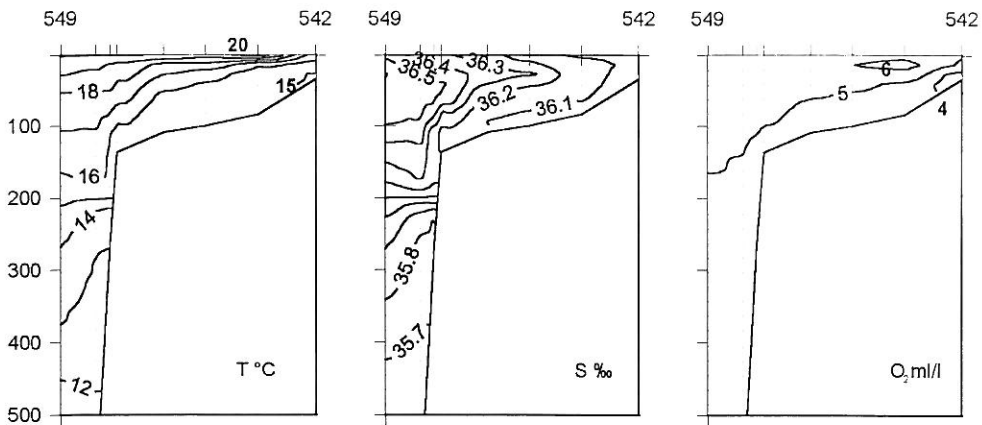
Figure 3b. Sea surface temperature (at 5 m depth), Cape Juby to Cape Cantin. Depth contours as in Fig. 1a.



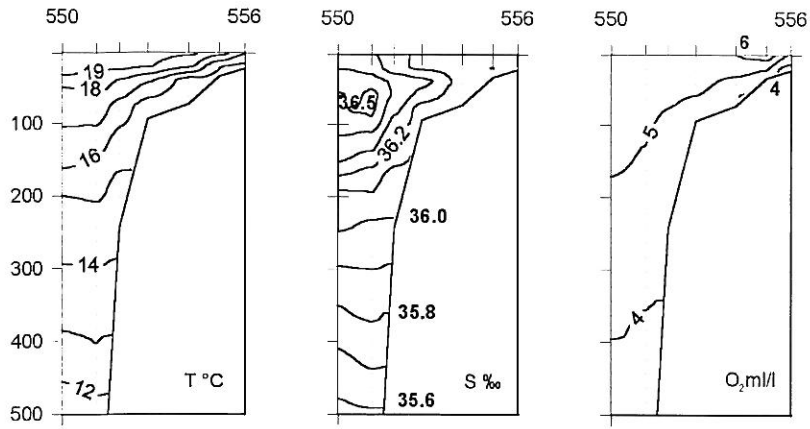
CAPE GHIR – 21.05.2003



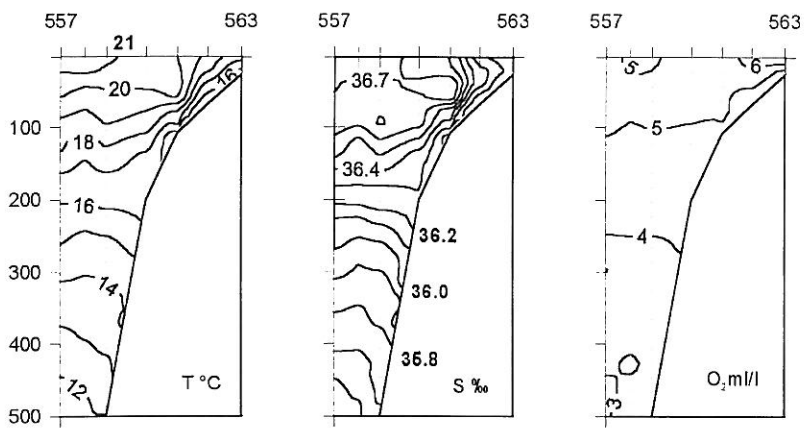
SIDI IFNI – 22.05.2003



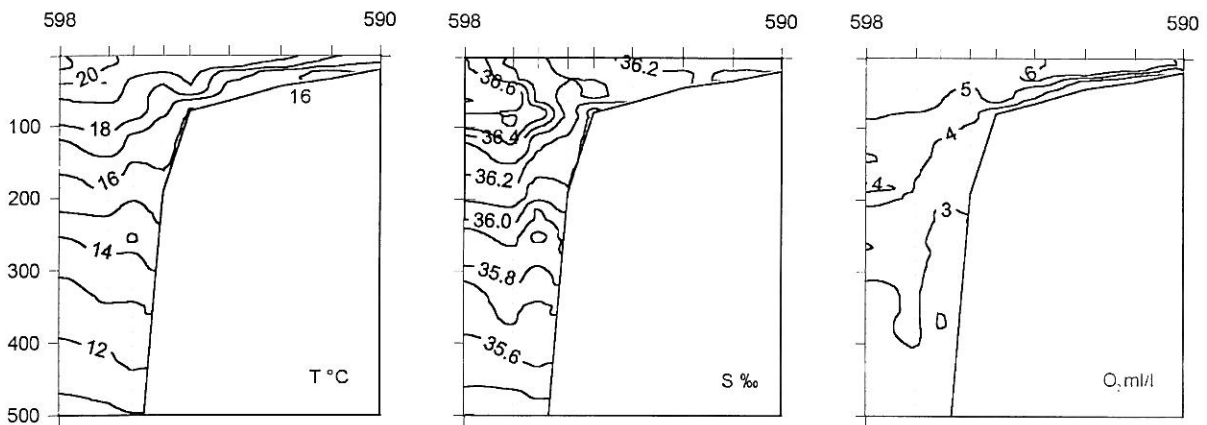
CAPE DRA – 23.05.2003



CAPE JUBY – 27.05.2003



CAPE BOJADOR – 30.05.2003



DAKHLA – 07.06.2003



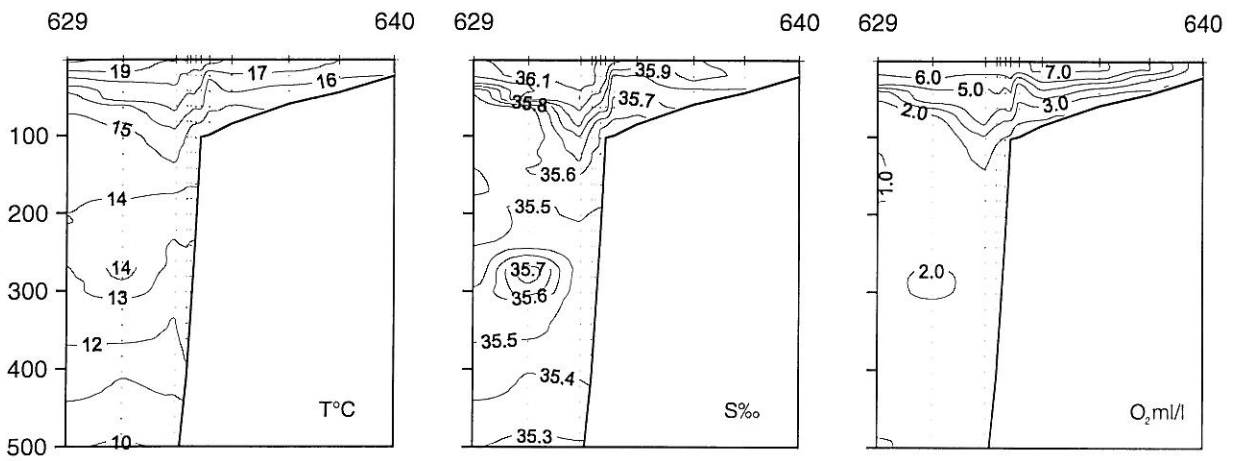
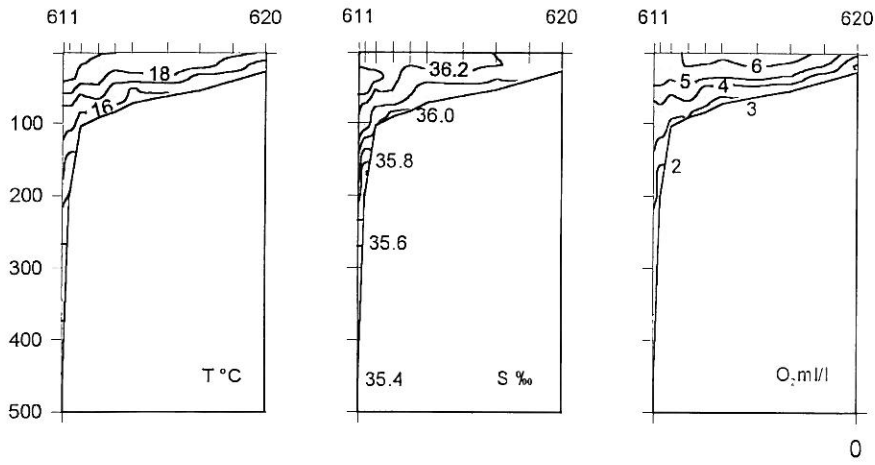


Figure 4. Hydrographic sections with distribution of temperature, salinity and oxygen.

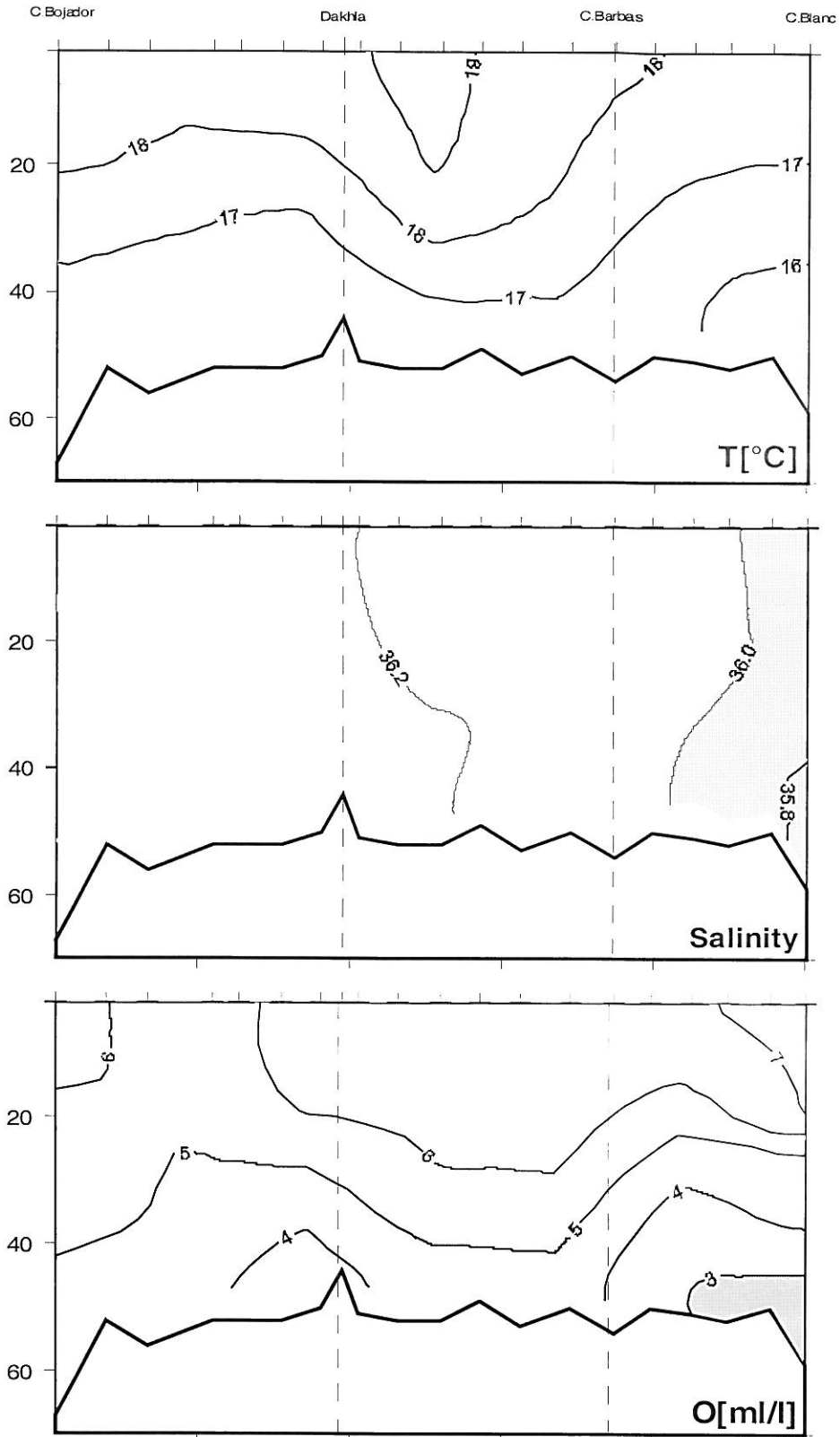


Figure 5a. Distribution of temperature, salinity and oxygen along the 50 m isobath.

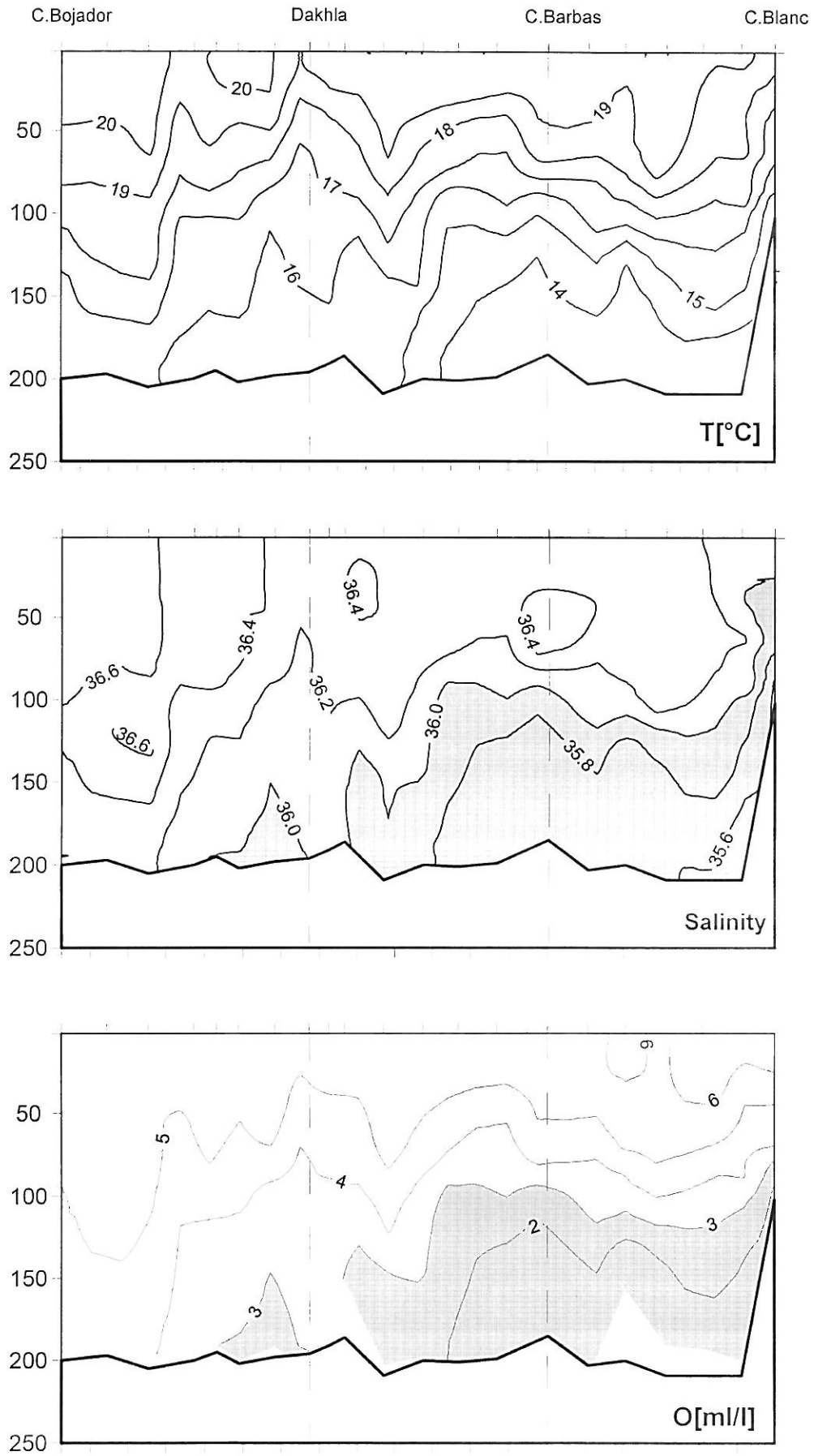


Figure 5b. Distribution of temperature, salinity and oxygen along the 200 m isobath.

## 2.2 Distribution of pelagic fish on the shelf from Cape Blanc to Cape Juby

Figures 6-9 to show the distribution of the main groups of pelagic fish by contoured acoustic densities.

**Sardine**, *Sardina pilchardus*, Figure 6, was found almost without interruption from Cape Blanc to Cape Juby. North of Cape Barbas there was mainly adult fish while juvenile fish were mixed in further south. The juveniles were extending south of Cape Blanc and seemed to have its centre of distribution there. The highest concentrations of sardine occurred between 23 and 25 °N, in line with previous surveys. Between Cape Bojador and Cape Juby the fish was a mixture of young and old fish, Figure 10a. Recruitment seems successful with abundant small sized sardine south of Cape Blanc, in Mauritania. This will be mapped and assessed in the following survey.

**Sardinellas** (*Sardinella aurita* and *Sardinella maderensis*) were found in a few patches north of Cape Barbas, but the main part of the fish was found within 60 NM north of Cape Blanc, Figure 7. It is expected that this distribution will extend into Mauritania.

**Horse mackerels** (*Trachurus trachurus* and *T. trecae*) were common from Cape Blanc to Cape Bojador, but mostly at low densities. A band of denser aggregations was located at the outer shelf off Cape Barbas, Figure 8.

**Chub mackerel** (*Scomber japonicus*) was more common than previously, perhaps more due to better training in discriminating the weak records of the species from plankton than actually an increase in abundance. As found further north, the species seems to form higher aggregations at some locations at the outer shelf. Figure 9.

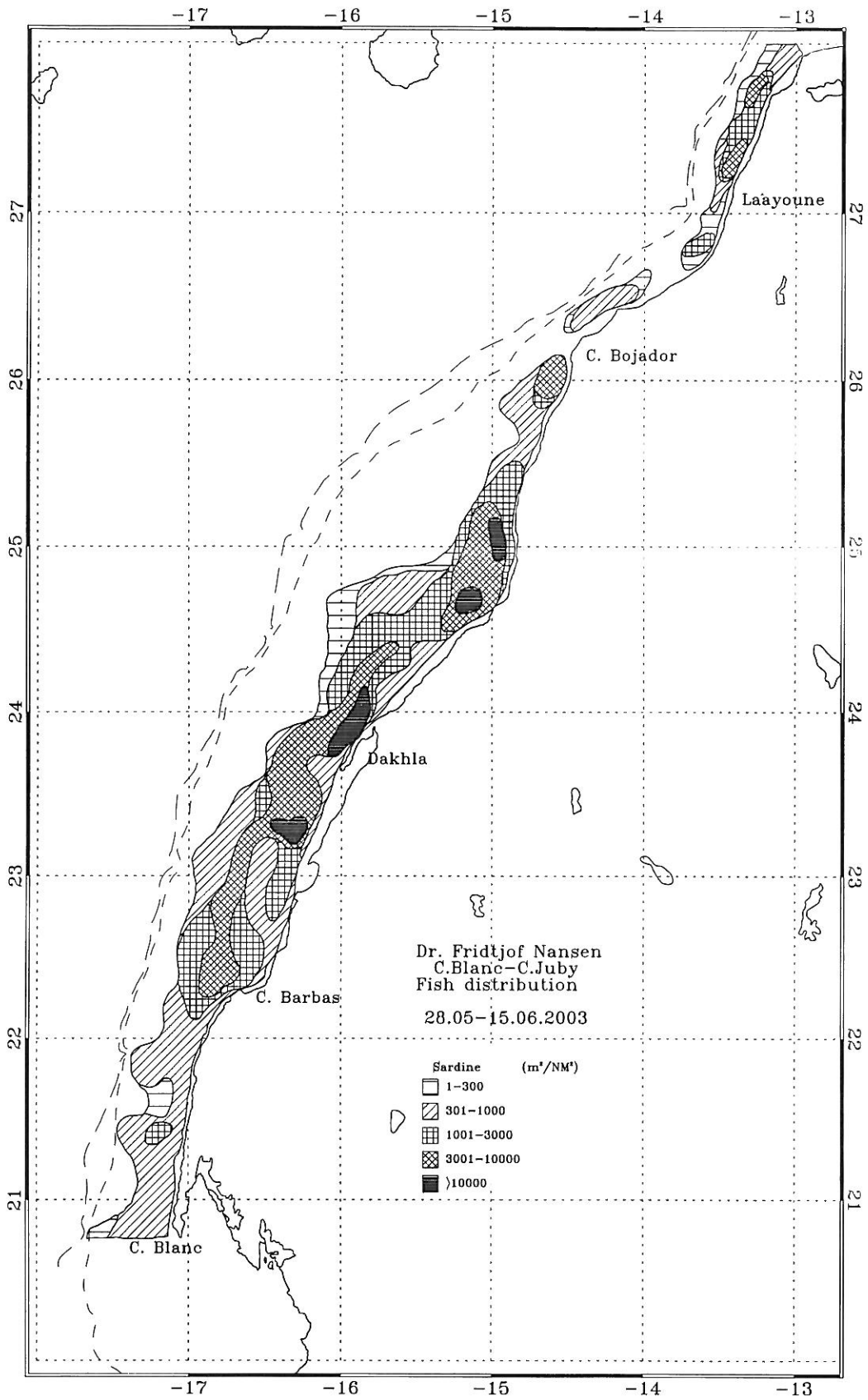


Figure 6. Distribution of sardine, Cape Blanc to Cape Juby. Depth contours as in Fig. 1a.

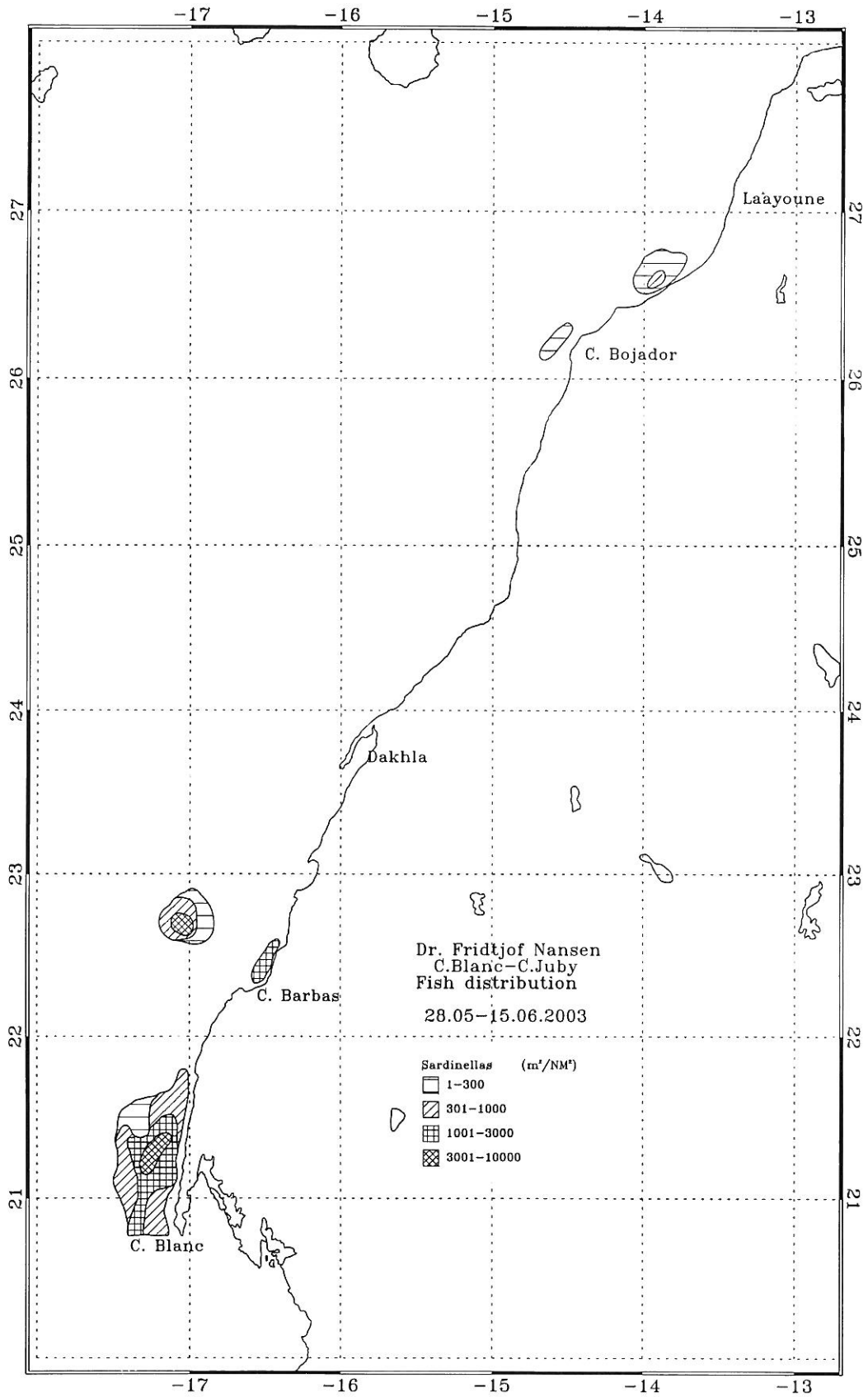


Figure 7. Distribution of sardinella, Cape Blanc to Cape Juby. Depth contours as in Fig. 1a.

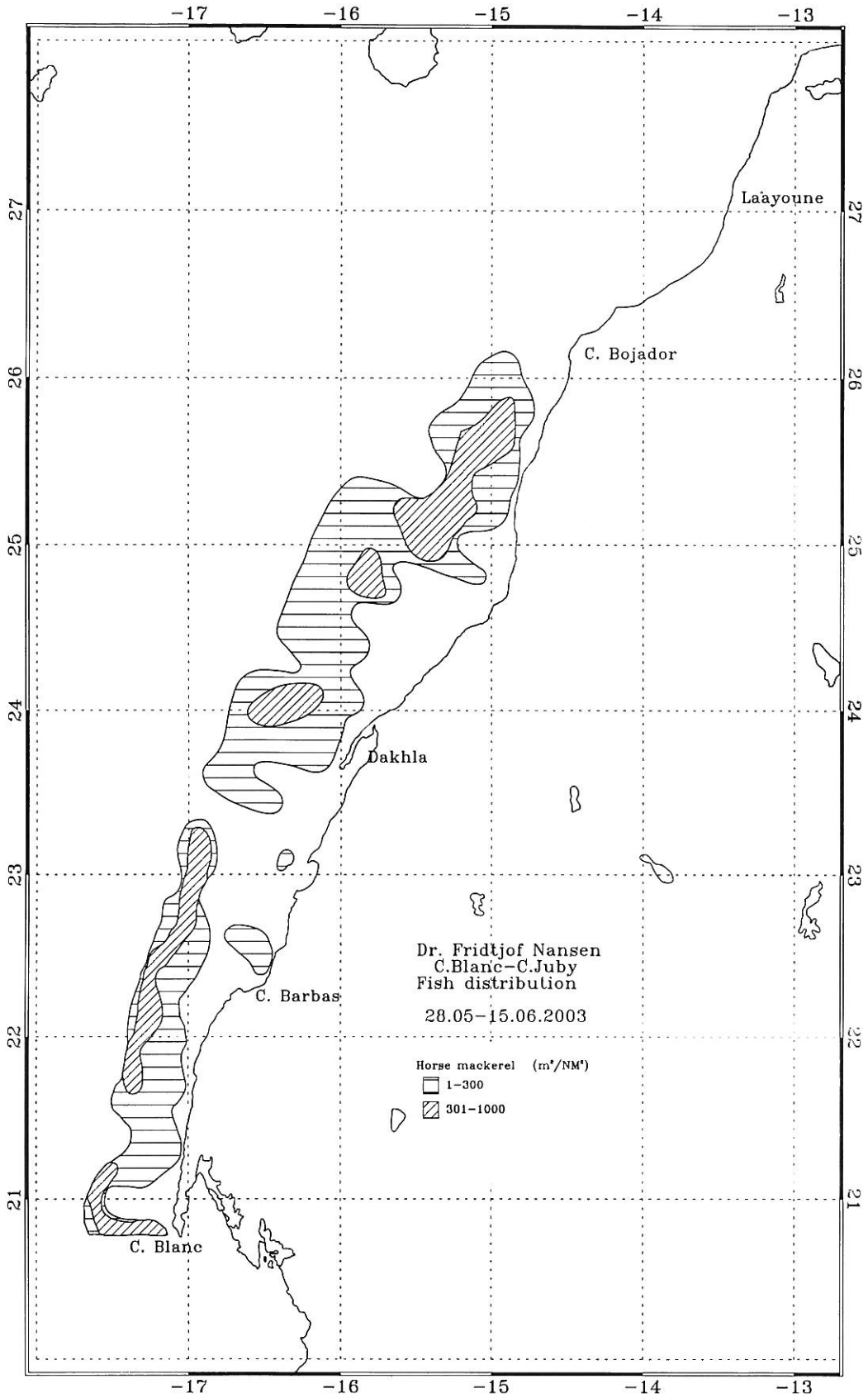


Figure 8. Distribution of horse mackerel, Cape Blanc to Cape Juby. Depth contours as in Fig. 1a.

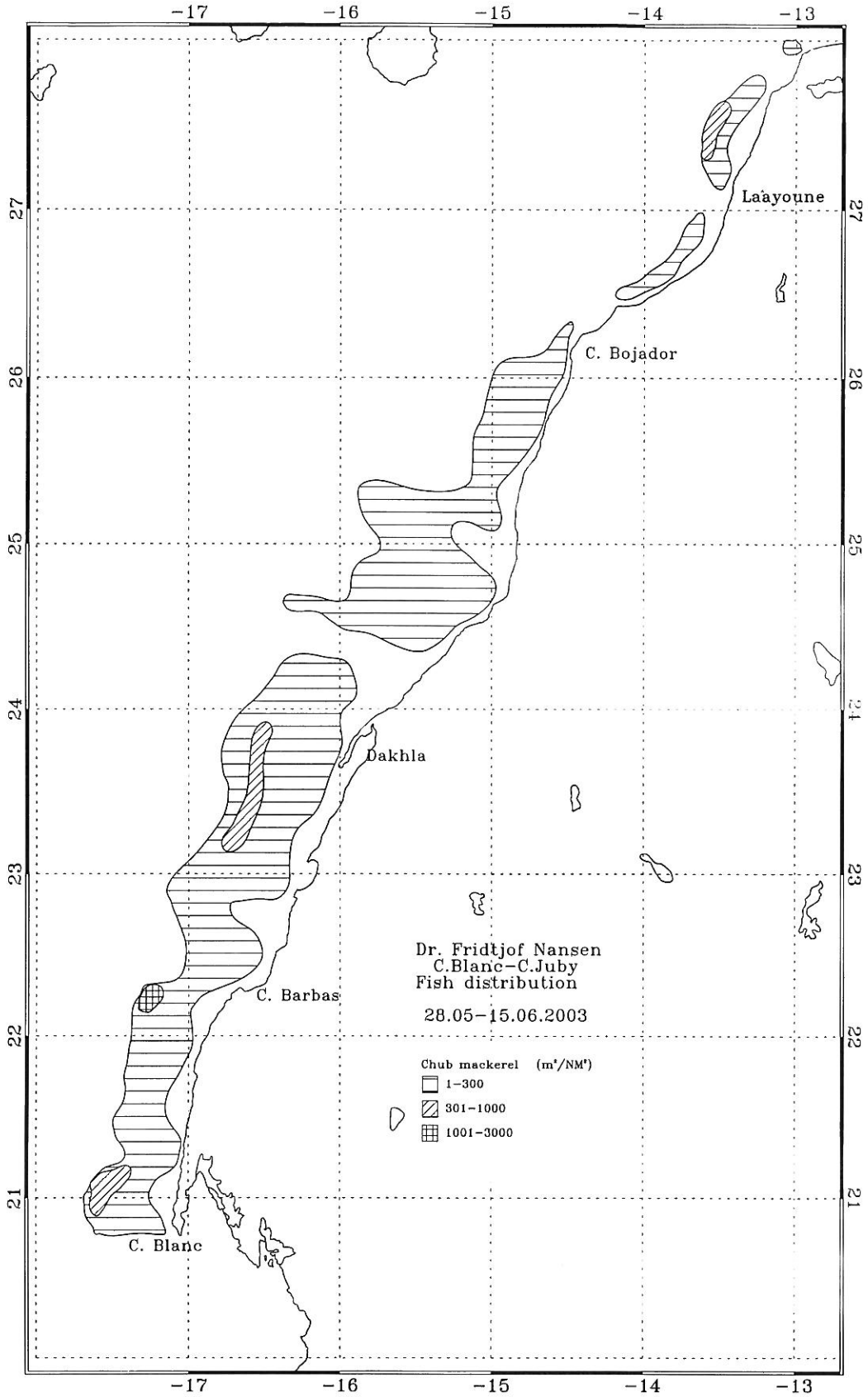


Figure 9. Distribution of chub mackerel, Cape Blanc to Cape Juby. Depth contours as in Fig. 1a.



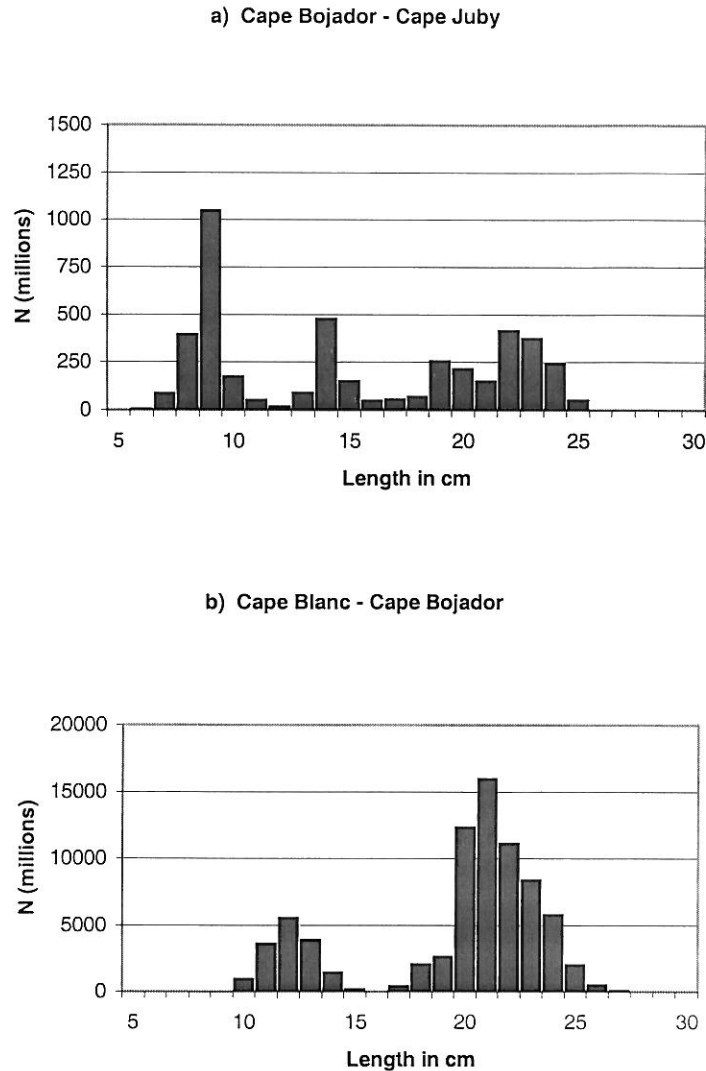


Figure 10. Length frequency distributions sardine Cape Blanc to Cape Juby.

### 2.3 Distribution of pelagic fish on the shelf from Cape Juby to Cape Cantin.

**Sardine**, Figure 11, was registered along most of the coast. The highest densities were recorded between Cape Juby and Sidi Ifni and between Cape Sim and Safi. The general picture has much resemblance with the previous surveys. The pooled length distributions on sardine, Figure 13, show that younger sardines with one dominant mode around 16 cm make up the main part of the sardine. Youngest year class with a mode around 8-9 cm is less prominent than last year.

**Anchovy** was found in several patches along the coast, and in more dense concentrations between Cape Dra and Cape Ghir, Figure 12. The distribution resembles much the situation during the previous survey, in December 2002.

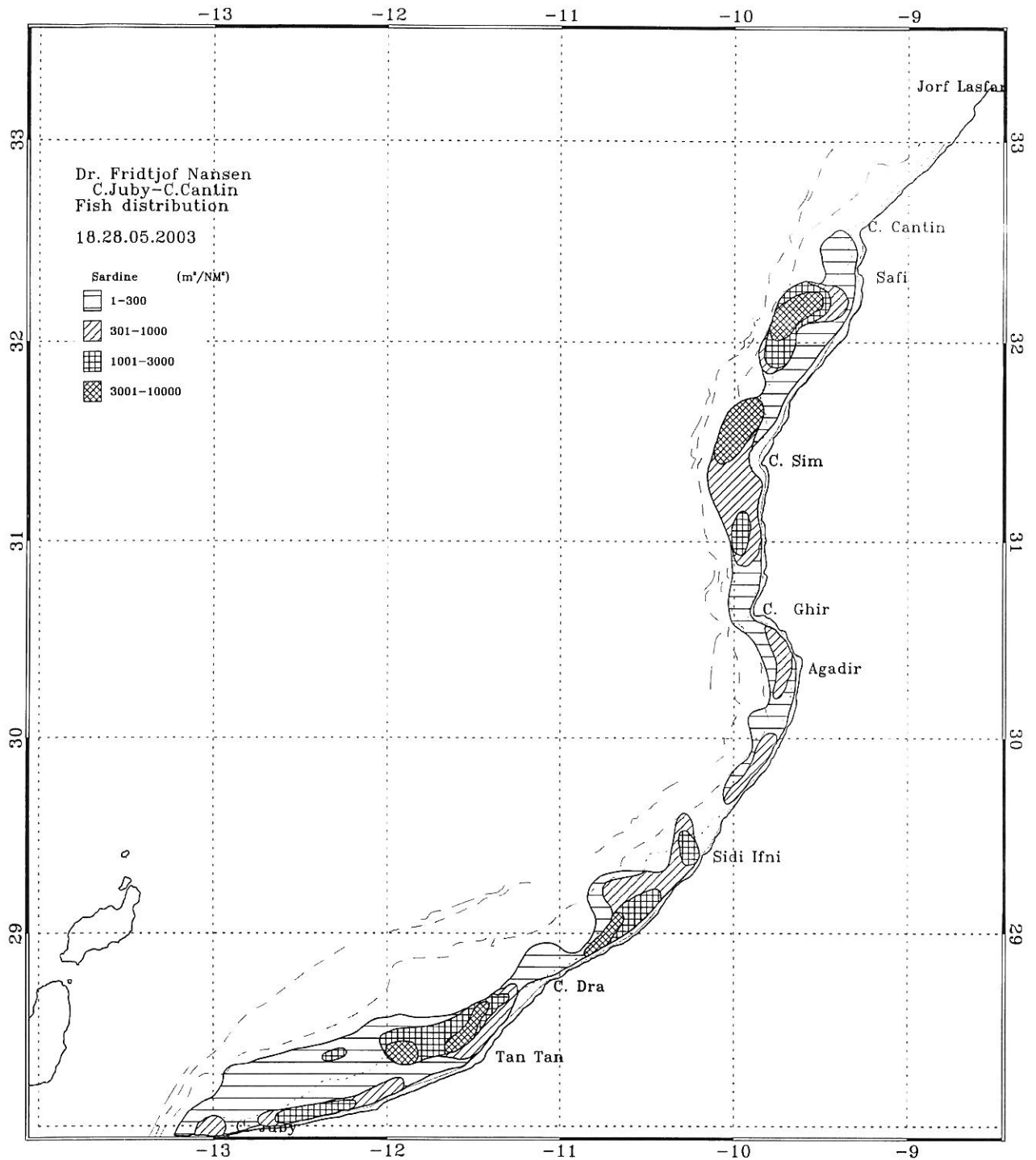


Figure 11. Distribution of sardine, Cape Juby to Cape Cantin. Depth contours as in Fig. 1a.

Recordings of **horse mackerel** and **chub mackerel** were rather few as expected from previous surveys in the region. Narrow bands of chub mackerel registered by the acoustic system at the shelf break off Tan Tan and off Cape Sim could indicate that the species is slightly more abundant in this area. This has also been recorded in June 2002 and it could be that the species tends to concentrate at the shelf edge.

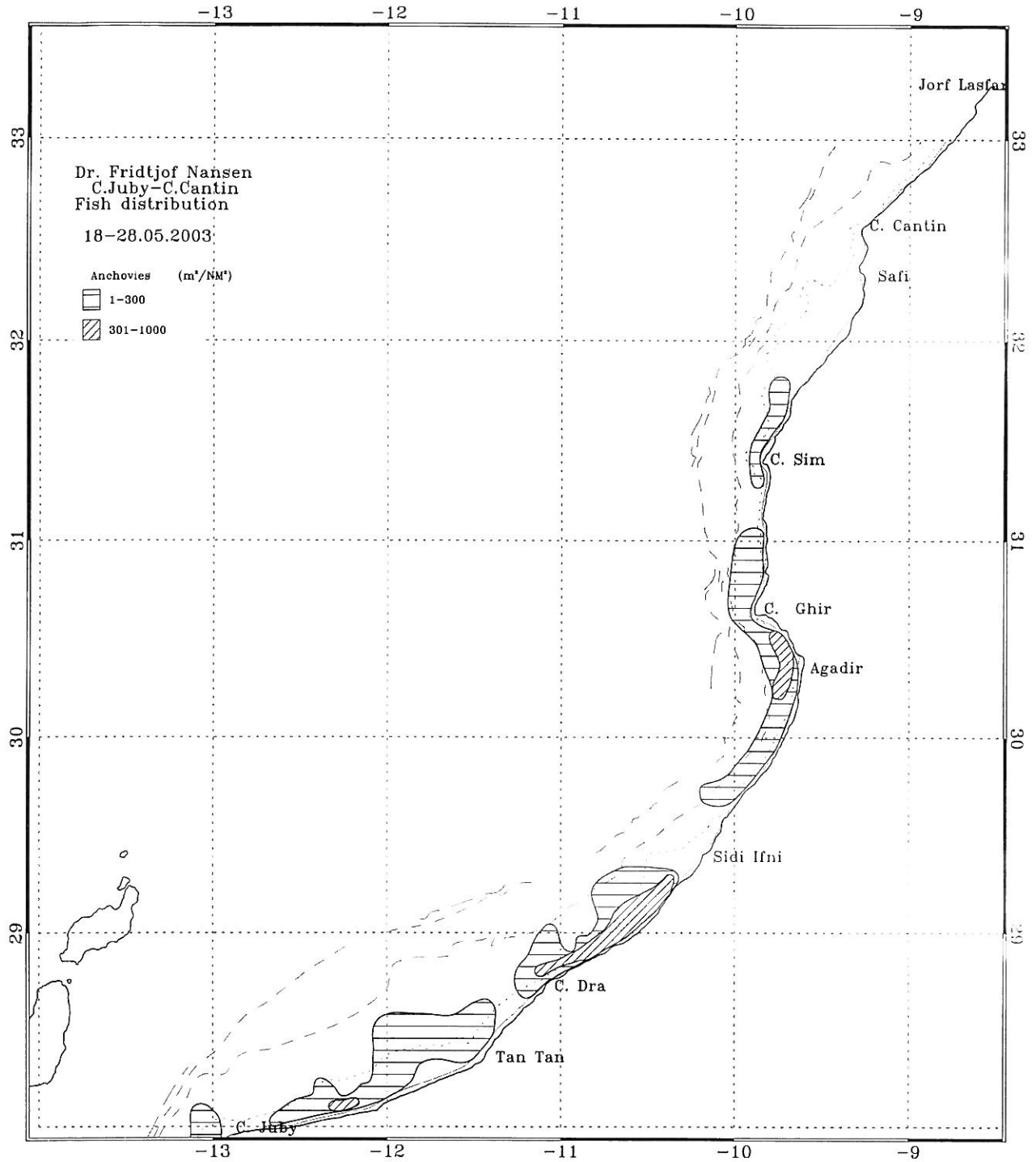


Figure 12. Distribution of anchovy, Cape Juby to Cape Cantin. Depth contours as in Fig. 1a.

a) Cape Juby - Cape Cantin

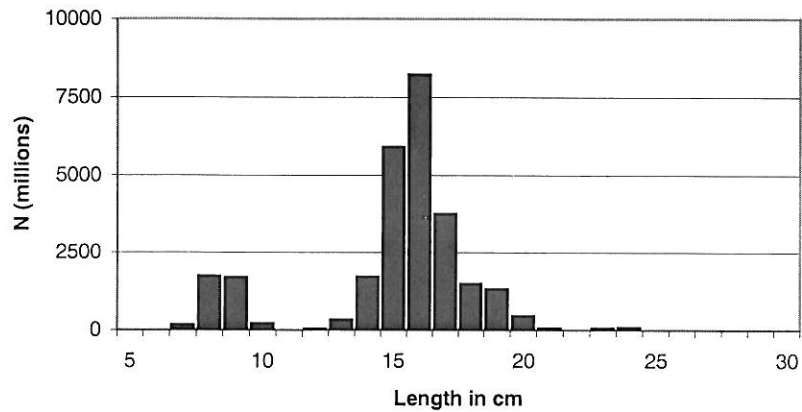


Figure 13. Length frequency distribution of sardine Cape Juby to Cape Cantin.

## 2.4 Biomass estimates

A summary on biomass estimates is given in Table 1 below. More detailed biomass estimates in number and weight by length groups are shown in Annex I.

### *Cape Blanc-Cape Bojador*

The **sardine** was estimated to 5.7 million tonnes, a 24% increase from the 3.5 million tonnes estimated in November 2002. The length distribution is earlier shown in Figure 10. Most of the fish in terms of biomass (90%) consist of older fish. Compared with earlier years, the development in the “adult” part of the stock (i.e. fish > 19 cm) is:

Survey	Thousand tonnes	Million fish
November-December 1996	4 600	47 400
November-December 1997	240	2 900
November-December 1998	340	3 400
November-December 1999	1 000	11 500
November-December 2000	1 260	13 200
May-June 2001 *	1 975	22 500
November-December 2001	3 200	32 000
May-June 2002 *	2 100	21 400
November-December 2002	3 700	35 500
June 2003 *	5 580	59 300

\* Including sardine in Mauritania

The strong increase in the adult stock since the previous survey is mainly due to a new year-class entering the adult stage. The young fish (< 20 cm), including the fish in Mauritanian waters, constitute of 50 billion fish, compared to 38 billion one year earlier.

**Sardinella** was estimated to 750 thousand tonnes consisting of 490 and 260 thousand tonnes of respectively round and flat sardinella. This estimate is a considerable increase from the 165 thousand tonnes estimated one year earlier, to compare similar seasons.

The two species of **horse mackerel** combined was estimated 500 thousand tonnes, of which 300 and 200 thousand tonnes were Atlantic and Cunene horse mackerel respectively.

#### *Cape Bojador-Cape Juby*

**Sardine** was estimated to 200 thousand tonnes, a slight reduction from the 220 thousand tonnes estimated in November 2002. The stock seems to be on a downward trend as the estimate was 650 thousand both in June 2002 and November 2001. In contrast to earlier years the main part of the stock (70%) in biomass is composed of adult fish bigger than 19 cm in length. Young fish is only 60 0000 tonnes in contrast to 200 000 tonnes one year earlier.

#### *Cape Juby – Cape Cantin*

The **sardine** is estimated to 940 thousand tonnes, much in line with the 900 000 estimated in December 2002. The stock seems to be on an increasing trend in biomass. Abundance in numbers is about 30 billion, close to the 35 billion estimated last December. The growth is therefore more from intrinsic growth than from new recruitment. The presence of fish of 6-11 cm length is only 20% compared to June 2002. This is a sign of weak recruitment.

**Anchovies** were estimated to 44 thousand tonnes much in line with the two previous estimates. One clear mode on 13 cm are found in the length distribution, Annex 1.

Region	Sardines	Round sardinella	Flat sardinella	Atlantic horse mackerel	Cunene horse mackerel	Chub mackerel	Anchovy
Cape Cantin-Cape Juby	940	0	0	40	0	55	44
Cape Juby-Cape Bojador	200	20	+	0	0	10	0
Cape Bojador-Cape Blanc	5 700	470	260	300	200	320	1
Totals	6 840	490	260	340	200	385	45

## CHAPTER 3 CONCLUDING REMARKS

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The survey was conducted in the period 18<sup>th</sup> May to 16<sup>th</sup> June. The survey area Cape Cantin-Cape Blanc was covered with an acoustic course track of 5100 NM and 87 fishing stations. The limits of the school areas of the sardine, anchovy and horse mackerel are thought to have been well determined and the main areas adequately sampled. The weather conditions were fine during the survey and did not put constraints on the survey work.

The hydrographic data indicate a calmer and warmer coastal climate during this survey than the long-term average. These calmer conditions and the associated increase in solar radiation, in the presence of active upwelling cells may have resulted in favourable environmental conditions for grazing of small pelagic fish in the inner parts of the shelf.

Figure 14 gives a general overview on the major aggregations of pelagic fish with rounded biomass figures. The biomass estimates are also summarised in Table 1.

Generally the sardine has a distribution pattern as normal for the season: juveniles south of Cape Barbas, extending into Mauritania and the main part of the adult southern stock between Cape Barbas and 25°N. The biomass of sardine between Cape Blanc and Cape Bojador has further increased from 4.6 million tonnes in November 2002 to 5.7 million during the last survey. Of this 5.1 million is old fish in the Dakhla region, while only 550 thousand tonnes is juvenile fish, found mixed with the adults south of Cape Barbas. Major aggregations of juvenile and adult sardine were recorded south off Cape Blanc. In addition two patches of sardine were found further south, off Cape Timiris. Total biomass south off Cape Blanc was estimated to 800 thousand tonnes.

Sardine in the region Cape Bojador-Cape Juby is estimated to 200 thousand tonnes, close to the estimate of 220 thousand in December 2002. The area holds considerable more juveniles compared to one year earlier, while the adult population is reduced about 25%. Further north, the stock between Cape Juby and Cape Cantin is estimated to 940 thousand tonnes, a slight and not significant increase from the 900 thousand estimated in December 2002. This fish continue to be composed of mainly one year class due to a persistent high fishing pressure.

The concentrations of sardinellas were mainly found between Cape Barbas and Cape Blanc. Round sardinella is estimated to 490 thousand tonnes, an increase from the 165 thousand tonnes from the same period previous year. Flat sardinella located north off Cape Blanc was estimated to 260 thousand tonnes. The fish recordings extend southwards into Mauritania.

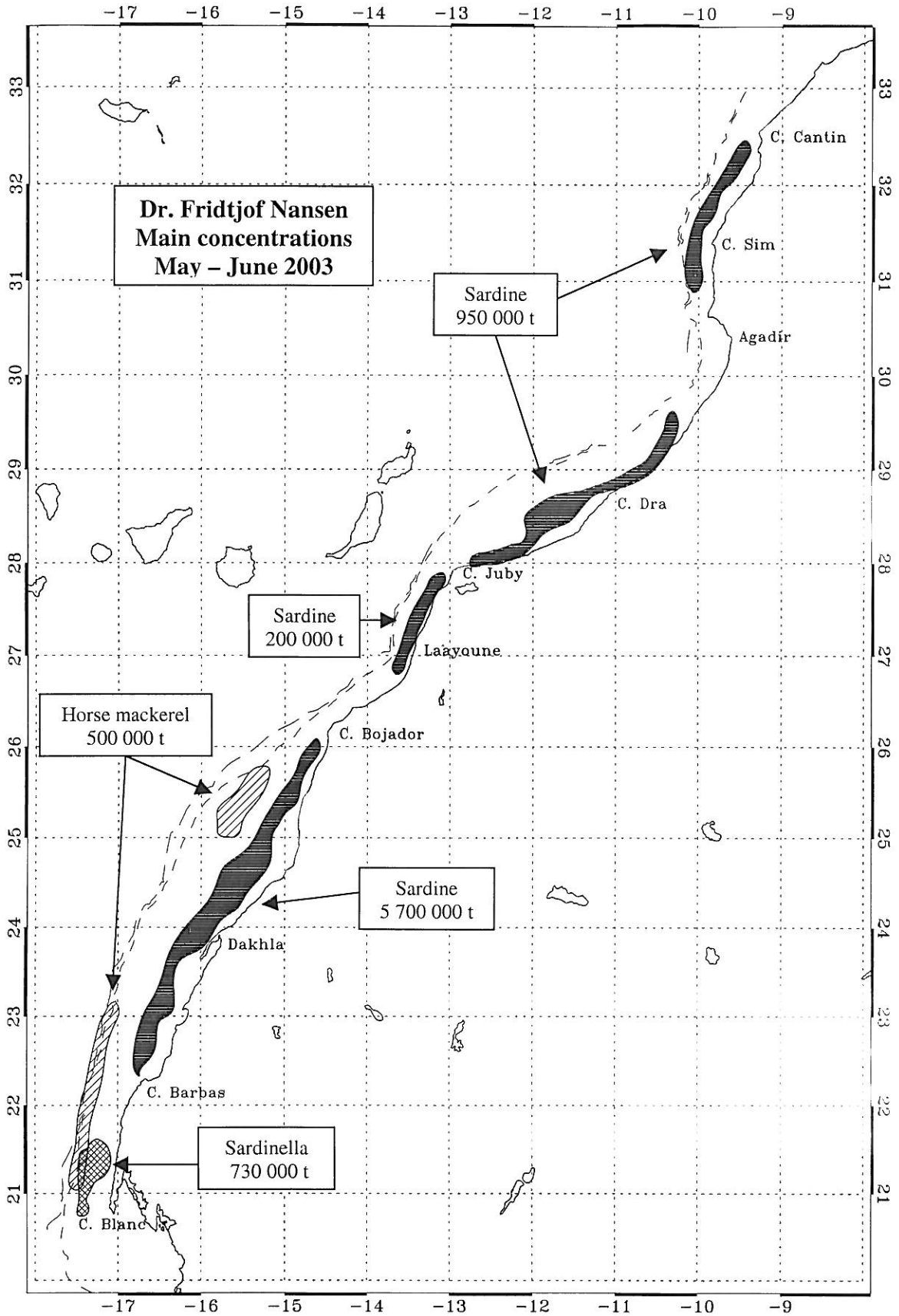


Figure 14. Map of the major pelagic fish concentrations with estimated abundance (tonnes), Cape Blanc to Cape Cantin.

Horse mackerel was found in aggregations between Cape Blanc and Cape Barbas. The estimate is 500 thousand tonnes.

Chub mackerel is generally recorded at low densities, somewhat higher in the region south of Dakhla. The estimate is 320 tonnes, of the same order of magnitude as in the two previous surveys. The species is probably considerably underestimated as the acoustic target strength is not quantified, but considerable lower than the sardine. This has not yet been compensated for in the calculations.

Anchovy was found in several patches in the central region, Cape Cantin-Cape Juby. The biomass was estimated to 45 thousand tonnes, of the same order as in the two previous surveys.

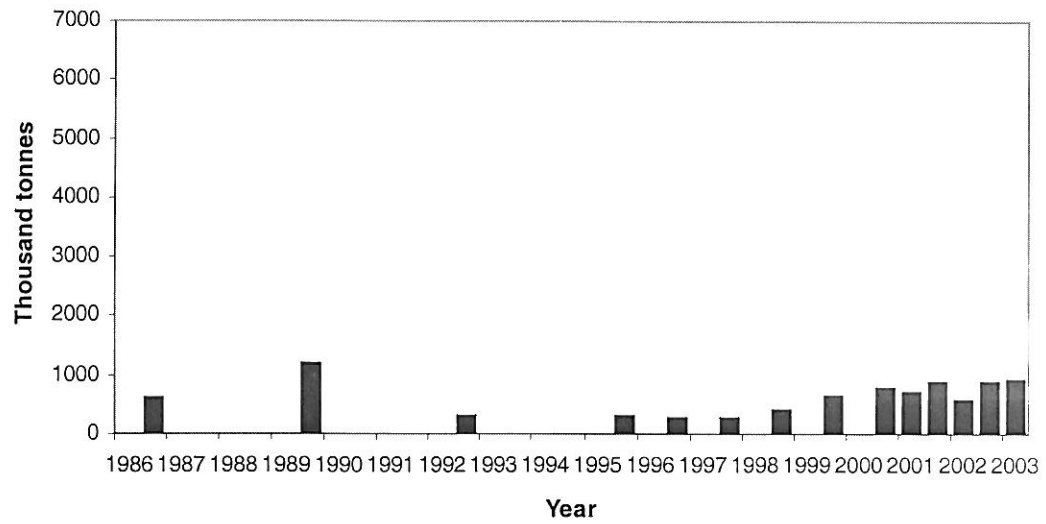
#### *Trends 1995-2003, sardine*

Figure 15 shows the biomass estimates of sardine compared with results from previous “Dr. Fridtjof Nansen” surveys. Figure 16 shows the biomass figures 1995-2003 by length classes. Both figures show that the southern stock, including the sardine between Cape Bojador and Cape Juby, has continued to grow during the last half-year. The growth is mainly in the adult part of the stock. As mentioned in the report from the December 2002-survey there are reasons to assume that the stock now approaches its upper limit, the present estimate is the highest in the time series of 20 years. One can therefore now safely shift from a strategy of rebuilding the stock to harvest it more intensively.

As in the later years, small fish with a modal length of 16 cm continue to dominate the central stock between Cape Juby and Safi. The stock seems to be in good shape, but as the fishery runs on one year-class of rather young fish there is a weak or no buffer if there should be a recruitment failure. The abundance, in numbers, of small sized sardine (<12 cm) is only 20% of that in May 2002. It looks therefore as if the present juveniles (13-19 cm) will have to carry the fishery also in 2004.



### Cape Cantin - Cape Juby



### Cape Juby - Cape Blanc

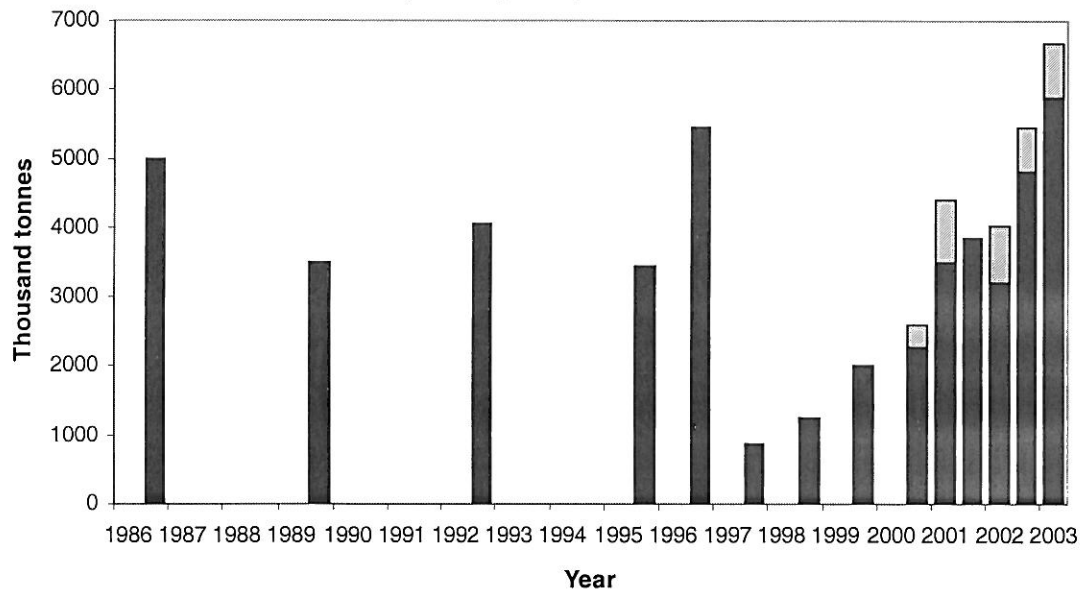


Figure 15. Sardine biomass estimates Cape Cantin-Cape Juby and Cape Juby-Cape Blanc. Sardine south off Cape Blanc hatched. Dr. Fridtjof Nansen 1986-2003.

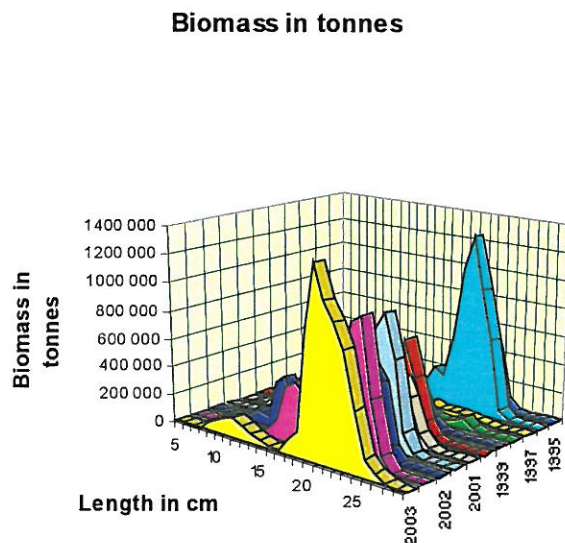
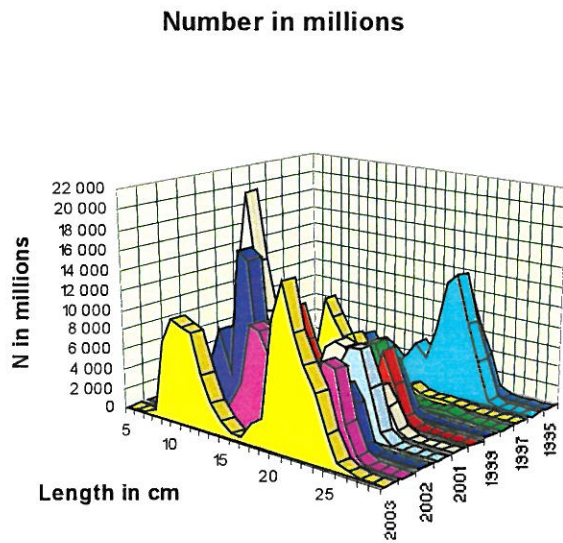
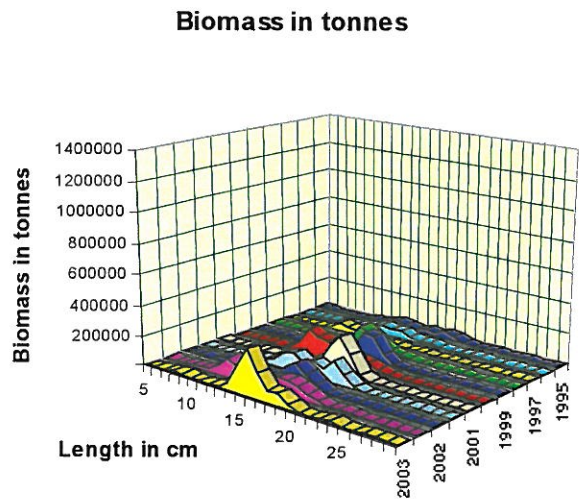
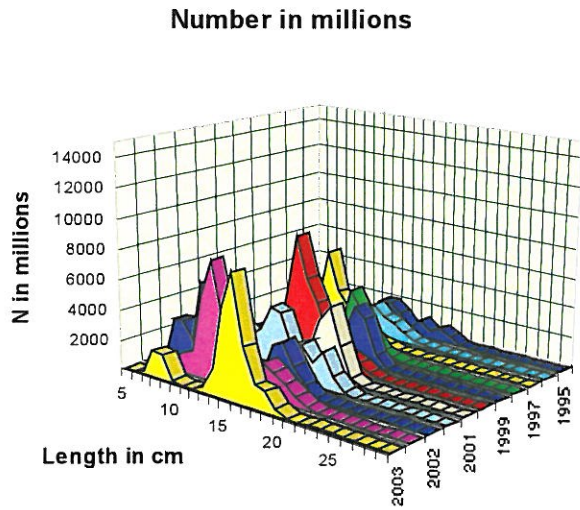


Figure 16. Numbers and biomass by length class, 1995-2003. Cape Cantin-Cape Juby (top) and Cape Juby-Cape Blanc (bottom). Sardine south off Cape Blanc included in lower figure.

## RESUMÉ

La campagne a été conduite avec succès durant la période du 18 Mai au 16 Juin 2003, elle a couvert la région entre Cap Cantin et Cap Blanc suivant un schéma de prospection acoustique de 5100 miles nautiques et 87 stations de pêche de contrôle. Les limites des zones des bancs de sardine, d'anchois, et du chinchard ont été bien déterminés et délimités et leurs principales zones adéquatement échantillonnées. Les conditions climatiques, généralement bonnes, n'ont pas causé de contraintes majeures à la prospection durant cette période.

Les observations météorologiques conduites durant cette prospection indiquent la présence d'upwelling dans les zones usuelles le long de la côte. La distribution de la température et de la salinité indiquent un climat côtier plus frais que prévu selon la moyenne saisonnière à long terme.

Une vision générale des majeures concentrations des poissons pélagiques, avec des valeurs de biomasses arrondies, est présentée dans la figure 14. Les estimations de biomasse sont également résumées dans la tableau 1.

Généralement, la distribution de la sardine présente le schéma normal pour cette saison: Les juvéniles au sud du Cap Barbas, en extension vers la Mauritanie. La majeure partie du stock est rencontrée dans la zone sud entre le Cap Barbas et 25 N: La biomasse entre Cap Bojador et Cap Blanc a augmenté de 4.6 million tonnes en décembre 2002 pour atteindre 5.7 million durant cette campagne, dont 5.1 million de poissons adultes dans la région, alors que 550 mille tonnes de juvéniles sont rencontrées en mélange avec des adultes au sud du Cap Barbas. Les juvéniles ont été enregistrés abondamment dans les eaux mauritaniennes, mais le résultat final doit attendre la fin de la mission qui sera conduite du 17 au 27 juin.

La biomasse de sardine entre Cap Juby et Cap Bojador est estimée à 200 mille tonnes, comparable à celle observée en décembre 2002. Cette zone comprend plus de juvéniles comparativement à l'année précédente, bien qu'une diminution sensible de la population a été observée l'année dernière. Cette diminution est probablement due à la forte pression de pêche exercée dans cette région.

Plus au nord, le stock sardinier entre Cap Juby et Cap Cantin est estimé à 940 mille tonnes, en légère augmentation par rapport aux 900 mille tonnes estimés en décembre 2002. Ce stock est essentiellement composé de poisson de classe d'âge de un an, ceci est due à la persistance de la forte pression de pêche .

Des concentrations de sardinelles ont été détectées entre Cap Blanc et Cap Barbas. Leur biomasse est estimée à 650 mille tonnes (490 mille tonnes de sardinelle ronde et 260 mille tonnes de Sardinelle plate), alors que 165 mille tonnes, seulement, ont été estimées. Les enregistrements de cette espèce continuent leur extension vers le sud dans les eaux Mauritaniennes

Le chinchard a été rencontré en forme d'agregats entre Cape Blanc et Cap Barbas. La biomasse est estimée à 500 mille tonnes qui est dans le même ordre de grandeur que l'année dernière.

Le maquereau européen est généralement enregistré en faible densités, quelque fois élevées dans la région de Dakhla. La biomasse est estimée á 320 mille tonnes, qui reste dans le même ordre de grandeur que celles des deux prospections de l'année dernière. Cette espèce est probablement sous-estimée du fait que sa puissance de réflexion acoustique (TS) n'est pas quantifiée, mais reste considerablement plus faible que la sardine. Les procédures de compensation n'ont pas encore été effectuées dans les calculs

Les détections d'anchois ont été enregistrés dans la région centrale entre le Cap Cantin et le Cap Juby. Sa biomasse, estimée à 45 mille tonnes, reste au même niveau que celle observée l'année dernière .

### ***Tendances du stock sardinier pendant la période 1995-2003***

La figure 15 montre les estimations de la biomasse de la sardine, comparées avec les précédentes évaluations effectuées lors des campagnes à bord du 'Dr. Fridtjof Nansen', les évaluations de la biomasse entre 1995 et 2003 sont présentées par classe de taille sur la figure 16. Les deux figures montrent que le stock entre Cap Blanc et Cap Juby présente une remarquable reconstitution progressive depuis sa chute observée à la fin de 1997 et a continué sa croissance ces six derniers mois. Par ailleurs, nous devons tenir compte des grandes quantités de juvéniles présentes dans les eaux mauritaniennes, qui font partie du stock, mais ne sont pas encore évaluées.

Comme mentionné dans le précédent rapport, il y a plusieurs raisons de supposer que le stock sud approche actuellement de sa limite maximale, L'estimation actuelle est la plus élevée durant ces 20 dernières années, Il est par conséquent possible, en toute securité, de changer de stratégie d'aménagement du stock sud d'une politique de reconstitution á celle d'une exploitation rationnelle.

Les poissons de taille modale de 16cm, observés durant ces dernières années dominant le stock central entre Cap Juby et Safi. Bien que ce stock semble bien se comporter, la pêche s'exerce sur les jeunes individus de classe d'age d'un an, ce qui implique une faible capacité d'effet tampon en cas d'échec de recrutement. En terme d'abondance, le nombre de petites sardines de tailles inferieures á 12 cm. est de 20% seulement de ce qu'il a été en Mai 2002, et il semble que les juveniles entre 13 et 19 cm. subiront l'effet de la pêche également pendant la saison 2004.

## Annex I Biomass and number by fish length class

### Sardine (*Sardina pilchardus*)

#### Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6		5		5
7	162	85		247
8	1 732	394		2 126
9	1 695	1 049		2 743
10	208	172	933	1 313
11	8	51	3 587	3 646
12	36	18	5 523	5 577
13	336	90	3 880	4 305
14	1 710	475	1 406	3 590
15	5 896	148	144	6 188
16	8 222	47		8 269
17	3 755	53	365	4 173
18	1 494	67	2 032	3 592
19	1 334	255	2 623	4 212
20	451	214	12 297	12 962
21	59	150	15 952	16 161
22		414	11 119	11 533
23	69	374	8 341	8 784
24	84	241	5 772	6 097
25	8	53	1 996	2 056
26			473	473
27			36	36
28			3	3
29			1	1
30				
Total	27 257	4 354	76 483	108 094

#### Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6		11		11
7	561	293		855
8	8 722	1 984		10 706
9	11 915	7 372		19 287
10	1 975	1 633	8 858	12 466
11	99	642	44 735	45 476
12	570	291	88 452	89 313
13	6 778	1 810	78 270	86 858
14	42 737	11 877	35 140	89 754
15	180 050	4 517	4 383	188 949
16	302 859	1 725		304 584
17	165 006	2 340	16 048	183 394
18	77 545	3 484	105 490	186 519
19	81 136	15 487	159 483	256 106
20	31 830	15 101	868 721	915 653
21	4 815	12 214	1 300 016	1 317 045
22		38 678	1 038 550	1 077 228
23	7 336	39 791	887 608	934 736
24	10 160	29 044	696 073	735 277
25	1 041	7 146	271 397	279 585
26			72 251	72 251
27			6 153	6 153
28			603	603
29			310	310
30				
Total	935 135	195 440	5 682 543	6 813 119

## Annex I continued

### Round sardinella (*Sardinella aurita*)

#### Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23			4.2	4.2
24			28.6	28.6
25			157.5	157.5
26			345.4	345.4
27			323.3	323.3
28			262.4	262.4
29			173.0	173.0
30			206.1	206.1
31		3.8	9.5	13.3
32		2.8	42.7	45.5
33		5.2	64.0	69.2
34		9.0	72.4	81.4
35		10.9	89.9	100.8
36		7.1	50.0	57.0
37		1.4	36.5	37.9
38		0.5	11.3	11.8
39			21.6	21.6
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
Total		40.7	1 898.3	1 938.9

#### Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23			514	514
24			3 952	3 952
25			24 552	24 552
26			60 416	60 416
27			63 202	63 202
28			57 090	57 090
29			41 740	41 740
30			54 964	54 964
31		1 111	2 799	3 910
32		915	13 766	14 682
33		1 838	22 615	24 453
34		3 467	27 941	31 408
35		4 573	37 818	42 391
36		3 241	22 836	26 077
37		703	18 088	18 791
38		254	6 083	6 336
39			12 516	12 516
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
Total		16 102	470 891	486 993

## Annex I continued

### Flat sardinella (*Sardinella maderensis*)

#### Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27			4.9	4.9
28			14.8	14.8
29			52.3	52.3
30			124.5	124.5
31			131.7	131.7
32			140.7	140.7
33			130.0	130.0
34			119.9	119.9
35			51.0	51.0
36		0.3	2.1	2.4
37				
38				
39				
40		0.2		0.2
41		0.2		0.2
42				
43				
44				
45				
46				
47				
48				
49				
50				
Total		0.6	772.1	772.7

#### Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27			998	998
28			3 334	3 334
29			13 034	13 034
30			34 273	34 273
31			39 928	39 928
32			46 854	46 854
33			47 419	47 419
34			47 766	47 766
35			22 125	22 125
36		149	993	1 142
37				
38				
39				
40		102		102
41		109		109
42				
43				
44				
45				
46				
47				
48				
49				
50				
Total		359	256 725	257 084

## Annex I continued

### Anchovy (*Engraulis encrasicolus*)

#### Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5	124.7			124.7
6	407.3	1.6		408.9
7	333.9	46.2		380.1
8	354.1	101.3		455.4
9	258.8	44.1		302.9
10	206.8	16.0		222.7
11	401.5	2.2		403.7
12	880.6	1.7		882.4
13	1 190.9	0.4		1 191.3
14	523.7	0.4		524.1
15	95.3			95.3
16	5.0			5.0
17				
18				
19				
20				
Total	4 782.6	213.9		4 996.5

#### Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5	112			112
6	604	2		606
7	761	105		866
8	1 174	336		1 510
9	1 198	204		1 402
10	1 293	100		1 392
11	3 297	18		3 315
12	9 288	18		9 306
13	15 822	6		15 828
14	8 621	7		8 629
15	1 916			1 916
16	122			122
17				
18				
19				
20				
Total	44 208	796		45 005



## Annex I continued

### Atlantic horse mackerel (*Trachurus trachurus*)

Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8	22.7			22.7
9	79.4			79.4
10	17.0			17.0
11			2.9	2.9
12	1.1		5.9	7.0
13			19.1	19.1
14			29.9	29.9
15			136.1	136.1
16			293.7	293.7
17			502.2	502.2
18			1 018.6	1 018.6
19			1 078.3	1 078.3
20			607.8	607.8
21			144.4	144.4
22			38.0	38.0
23			14.8	14.8
24			7.8	7.8
25			45.6	45.6
26			72.4	72.4
27			72.3	72.3
28			36.7	36.7
29			38.5	38.5
30			29.8	29.8
31			31.4	31.4
32			27.9	27.9
33	1.7		22.7	24.4
34				
35	3.8			3.8
36	2.1			2.1
37	1.7			1.7
38	5.4			5.4
39	2.7			2.7
40	24.9			24.9
41	4.9			4.9
42	9.0			9.0
43	12.3			12.3
44	1.8			1.8
45				
46				
47				
48				
49				
50				
Total	190.5		4 277.0	4 467.5

Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8	117			117
9	572			572
10	166			166
11			38	38
12	19		97	115
13			395	395
14			764	764
15			4 256	4 256
16			11 083	11 083
17			22 609	22 609
18			54 177	54 177
19			67 165	67 165
20			43 985	43 985
21			12 052	12 052
22			3 635	3 635
23			1 617	1 617
24			961	961
25			6 354	6 354
26			11 315	11 315
27			12 636	12 636
28			7 146	7 146
29			8 311	8 311
30			7 101	7 101
31			8 255	8 255
32			8 043	8 043
33	544		7 167	7 710
34				
35	1 428			1 428
36	849			849
37	762			762
38	2 578			2 578
39	1 373			1 373
40	13 885			13 885
41	2 970			2 970
42	5 779			5 779
43	8 478			8 478
44	1 325			1 325
45				
46				
47				
48				
49				
50				
Total	40 845		299 163	340 008

## Annex I continued

### Cunene horse mackerel (*Trachurus trecae*)

#### Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10			17.9	17.9
11			170.2	170.2
12			454.1	454.1
13			1 603.5	1 603.5
14			1 889.7	1 889.7
15			1 458.3	1 458.3
16			620.9	620.9
17			242.7	242.7
18			57.6	57.6
19			11.5	11.5
20			19.1	19.1
21			3.1	3.1
22				
23			8.0	8.0
24			24.2	24.2
25			61.3	61.3
26			60.3	60.3
27			36.0	36.0
28			7.9	7.9
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
Total			6 746.4	6 746.4

#### Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10			174	174
11			2 174	2 174
12			7 450	7 450
13			33 141	33 141
14			48 391	48 391
15			45 617	45 617
16			23 430	23 430
17			10 926	10 926
18			3 065	3 065
19			716	716
20			1 384	1 384
21			255	255
22				
23			876	876
24			2 994	2 994
25			8 539	8 539
26			9 424	9 424
27			6 285	6 285
28			1 545	1 545
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
Total			206 385	206 385

## Annex I continued

### Chub mackerel (*Scomber japonicus*)

#### Numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10				
11		63.2		63.2
12		11.0		11.0
13	42.0	1.8	13.5	57.4
14	497.1	0.6	101.0	598.7
15	231.0	0.6	216.1	447.8
16	21.0	0.6	223.0	244.6
17	0.8		97.7	98.5
18			44.3	44.3
19			32.8	32.8
20	5.9		54.1	60.0
21	16.8	0.1	91.2	108.1
22	29.2	1.4	122.4	153.0
23	61.0	13.5	151.6	226.0
24	43.8	27.3	154.9	226.0
25	5.1	4.5	104.5	114.2
26	14.5	4.8	98.5	117.8
27	4.9	4.8	175.7	185.4
28		9.5	267.7	277.2
29	1.0	5.3	142.2	148.5
30	0.5	7.5	109.6	117.6
31	11.8	2.6	45.2	59.7
32	13.9	1.5	37.1	52.5
33	9.9	0.8	28.0	38.7
34	2.0	1.1	9.9	13.0
35	4.0	0.7	9.0	13.7
36		0.3	1.5	1.8
37			6.9	6.9
38				
39			2.7	2.7
40			0.1	0.1
41			3.3	3.3
42			3.2	3.2
43			0.1	0.1
44			0.3	0.3
45			0.3	0.3
46			0.3	0.3
47			0.2	0.2
48			0.1	0.1
49			0.1	0.1
50			0.1	0.1
Total	1 016.0	163.8	2 349.3	3 529.1

#### Biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Bojador	C. Bojador- C. Blanc	TOTAL
5				
6				
7				
8				
9				
10				
11		807		807
12		181		181
13	868	38	279	1 185
14	12 729	16	2 587	15 332
15	7 227	19	6 761	14 007
16	793	23	8 413	9 229
17	36		4 400	4 436
18			2 357	2 357
19			2 041	2 041
20	427		3 915	4 342
21	1 402	4	7 617	9 024
22	2 789	138	11 713	14 640
23	6 651	1 468	16 522	24 641
24	5 405	3 378	19 134	27 917
25	716	625	14 561	15 902
26	2 263	756	15 403	18 422
27	851	839	30 694	32 385
28		1 856	52 047	53 903
29	207	1 153	30 672	32 032
30	114	1 795	26 130	28 039
31	3 110	687	11 877	15 674
32	4 000	432	10 700	15 132
33	3 115	244	8 856	12 215
34	684	386	3 402	4 471
35	1 489	259	3 400	5 149
36		141	613	754
37			3 078	3 078
38				
39			1 385	1 385
40			32	32
41			1 979	1 979
42			2 055	2 055
43			40	40
44			213	213
45			273	273
46			243	243
47			207	207
48			55	55
49			117	117
50			62	62
Total	54 877	15 246	303 834	373 956

# Annex II Records of fishing stations

PROJECT STATION:1880  
 DATE:19/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 3222  
 start stop duration Long W 943  
 TIME :08:38:33 08:57:20 19 (min) Purpose code: 1  
 LOG :2373.19 2374.37 1.18 Area code : 1  
 FDEPTH: 25 40 GearCond.code:  
 BDEPTH: 139 153 Validity code:  
 Towing dir: 295e Wire out: 150 m Speed: 35 kn\*10  
 Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
N O C A T C H	0.00		

PROJECT STATION:1881  
 DATE:19/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 3211  
 start stop duration Long W 928  
 TIME :13:45:31 13:58:06 13 (min) Purpose code: 1  
 LOG :2419.25 2420.09 0.83 Area code : 1  
 FDEPTH: 20 25 GearCond.code:  
 BDEPTH: 43 46 Validity code:  
 Towing dir: 190e Wire out: 85 m Speed: 40 kn\*10  
 Sorted: 35 Kg Total catch: 1995.00 CATCH/HOUR: 9207.69

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardina pilchardus	9207.69	214846	100.00 3138
Total	9207.69	100.00	

PROJECT STATION:1882  
 DATE:19/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 3205  
 start stop duration Long W 945  
 TIME :18:28:53 18:45:16 16 (min) Purpose code: 1  
 LOG :2459.46 2460.51 1.03 Area code : 1  
 FDEPTH: 25 20 GearCond.code:  
 BDEPTH: 62 85 Validity code:  
 Towing dir: 290e Wire out: 100 m Speed: 35 kn\*10  
 Sorted: 38 Kg Total catch: 377.97 CATCH/HOUR: 1417.39

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardina pilchardus	1410.00	35400	99.48 3139
Scomber japonicus	7.99	23	0.52
Total	1417.99	100.00	

PROJECT STATION:1883  
 DATE:19/ 5/03 GEAR TYPE: PT No: 3 POSITION:Lat N 3156  
 start stop duration Long W 949  
 TIME :23:24:33 23:40:30 16 (min) Purpose code: 1  
 LOG :2503.45 2504.41 0.96 Area code : 1  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 39 42 Validity code:  
 Towing dir: 108e Wire out: 80 m Speed: 36 kn\*10  
 Sorted: 34 Kg Total catch: 511.73 CATCH/HOUR: 1918.99

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardina pilchardus	1800.00	55913	93.80 3140
Scomber japonicus	109.69	956	5.72 3141
Lepidopus caudatus	6.00	4	0.31
Trachurus trachurus	3.00	4	0.16
Total	1918.69	99.99	

PROJECT STATION:1884  
 DATE:20/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 3139  
 start stop duration Long W 947  
 TIME :05:03:47 05:34:00 30 (min) Purpose code: 1  
 LOG :2555.35 2557.30 1.94 Area code : 1  
 FDEPTH: 20 20 GearCond.code:  
 BDEPTH: 37 38 Validity code:  
 Towing dir: 345e Wire out: 80 m Speed: 40 kn\*10  
 Sorted: 38 Kg Total catch: 38.89 CATCH/HOUR: 77.78

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Trachurus trachurus	29.30	46	37.67 3144
Sardina pilchardus	20.30	5868	26.10 3142
Engraulis encrasicolus	16.16	7686	20.78 3145
Trachurus trachurus, juveniles	4.06	672	5.22 3143
Lepidopus caudatus	2.40	2	3.09
Diplodus vulgaris	1.78	2	2.29
C R A B S	1.28	124	1.65
Scomber scombrus	1.24	8	1.59
Alloteuthis subulata	0.80	254	1.03
Scomber japonicus	0.40	12	0.51
Merluccius merluccius	0.06	9	0.08 1
Total	77.78	100.01	

PROJECT STATION:1885  
 DATE:20/ 5/03 GEAR TYPE: BT No: 2 POSITION:Lat N 3131  
 start stop duration Long W 1011  
 TIME :10:35:21 10:48:58 14 (min) Purpose code: 1  
 LOG :2603.56 2604.33 0.77 Area code : 1  
 FDEPTH: 140 137 GearCond.code:  
 BDEPTH: 140 137 Validity code:  
 Towing dir: 190e Wire out: 400 m Speed: 34 kn\*10  
 Sorted: 62 Kg Total catch: 62.00 CATCH/HOUR: 265.71

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Trachurus picturatus	71.40	154	26.87
Dentex maroccanus	35.27	176	13.27
Peristedion cataphractum	21.43	107	8.07
Pagrus pagrus	20.57	9	7.74
Macrorhamphosus scolopax	18.30	1491	6.89
Pagellus acarne	16.50	64	6.21
Lepidopus caudatus	14.57	17	5.48
Capros aper	14.23	1011	5.36
Dentex macrophthalmus	11.27	107	4.24
Merluccius merluccius	10.50	34	3.95
Pagellus bogaraveo	10.29	39	3.87
Trachurus trachurus	7.93	17	2.98
Anthias anthias	7.63	364	2.87
Mullus surmuletus	2.91	9	1.10
Zeus faber	2.01	9	0.76
Illex coindetii	0.90	34	0.34
Total	265.71	100.00	

PROJECT STATION:1886  
 DATE:20/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 3119  
 start stop duration Long W 958  
 TIME :15:11:41 15:33:29 22 (min) Purpose code: 1  
 LOG :2642.74 2644.16 1.41 Area code : 1  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 89 96 Validity code:  
 Towing dir: 180e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 36 Kg Total catch: 474.24 CATCH/HOUR: 1293.38

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardina pilchardus	1269.27	42758	98.14 3146
Engraulis encrasicolus	14.18	815	1.10 3147
Scomber japonicus	9.93	177	0.77
Total	1293.38	100.01	

PROJECT STATION:1887  
 DATE:20/ 5/03 GEAR TYPE: PT No: 3 POSITION:Lat N 3058  
 start stop duration Long W 958  
 TIME :22:21:46 22:51:10 29 (min) Purpose code: 1  
 LOG :2708.02 2709.74 1.71 Area code : 1  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 88 78 Validity code:  
 Towing dir: 90e Wire out: 100 m Speed: 35 kn\*10  
 Sorted: 37 Kg Total catch: 279.98 CATCH/HOUR: 579.27

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardina pilchardus	489.52	17189	84.51 3148
Engraulis encrasicolus	26.79	1666	4.62 3149
Lepidopus caudatus	22.76	17	3.93
Trachurus trachurus	17.90	33	3.09 3150
Merluccius merluccius	10.72	58	1.85
C R A B S	7.97	637	1.38
Alloteuthis subulata	3.62	854	0.62
Total	579.28	100.00	

PROJECT STATION:1888  
 DATE:21/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 3025  
 start stop duration Long W 947  
 TIME :13:21:51 13:37:13 15 (min) Purpose code: 1  
 LOG :2830.05 2831.08 1.03 Area code : 1  
 FDEPTH: 55 50 GearCond.code:  
 BDEPTH: 81 82 Validity code:  
 Towing dir: 170e Wire out: 220 m Speed: 40 kn\*10  
 Sorted: 49 Kg Total catch: 284.35 CATCH/HOUR: 1137.40

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardina pilchardus	577.60	17984	50.78 3152
Engraulis encrasicolus	499.20	30208	43.89 3153
Trachurus trachurus	37.00	72	3.25 3151
Lepidopus caudatus	23.60	12	2.07
Total	1137.40	99.99	

PROJECT STATION:1889  
 DATE:21/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 3024  
 start stop duration Long W 1007  
 TIME :16:06:33 16:36:28 30 (min) Purpose code: 1  
 LOG :2851.98 2853.71 1.72 Area code : 1  
 FDEPTH: 225 250 GearCond.code:  
 BDEPTH: 450 456 Validity code:  
 Towing dir: 190e Wire out: 800 m Speed: 40 kn\*10  
 Sorted: Kg Total catch: 7.80 CATCH/HOUR: 15.60

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
MYCTOPHIDAE	8.00	6720	51.28
Mola mola	6.00	2	38.46
Lepidopus caudatus	1.60	2	10.26
Total	15.60	100.00	

PROJECT STATION:1890  
 DATE:22/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2950  
 start stop duration Long W 954  
 TIME :02:26:52 02:36:41 10 (min) Purpose code: 1  
 LOG :2951.78 2952.44 0.65 Area code : 1  
 FDEPTH: 15 12 GearCond.code:  
 BDEPTH: 56 62 Validity code:  
 Towing dir: 340e Wire out: 80 m Speed: 40 kn\*10  
 Sorted: Kg Total catch: 22.40 CATCH/HOUR: 134.40

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	84.30	1878	62.72	3156
Scomber japonicus	28.98	96	21.56	3157
Engraulis encrasicolus	11.46	756	8.53	3155
Lepidopus caudatus	9.66	6	7.19	
Total	134.40		100.00	

PROJECT STATION:1896  
 DATE:24/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2856  
 start stop duration Long W 1111  
 TIME :09:25:58 09:54:00 28 (min) Purpose code: 1  
 LOG :3436.21 3437.86 1.63 Area code : 1  
 FDEPTH: 30 30 GearCond.code:  
 BDEPTH: 91 92 Validity code:  
 Towing dir: 40e Wire out: 120 m Speed: 35 kn\*10  
 Sorted: Kg Total catch: 0.07 CATCH/HOUR: 0.15

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Engraulis encrasicolus	0.11	9	73.33	
C R A B S	0.04	4	26.67	
Total	0.15		100.00	

PROJECT STATION:1891  
 DATE:22/ 5/03 GEAR TYPE: PT No: 7 POSITION:Lat N 2916  
 start stop duration Long W 1020  
 TIME :20:36:19 20:51:54 16 (min) Purpose code: 1  
 LOG :3114.31 3115.22 0.90 Area code : 1  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 28 31 Validity code:  
 Towing dir: 40e Wire out: 80 m Speed: 35 kn\*10  
 Sorted: 27 Kg Total catch: 27.53 CATCH/HOUR: 103.24

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	62.44	3000	60.48	3158
Engraulis encrasicolus	29.06	2801	28.15	3159
C R A B S	8.81	788	8.53	
Merluccius senegalensis	0.90	23	0.87	
Campogramma glycos	0.79	11	0.77	
Scomber japonicus	0.75	8	0.73	
Alloteuthis subulata	0.49	191	0.47	
Total	103.24		100.00	

PROJECT STATION:1897  
 DATE:24/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2839  
 start stop duration Long W 1119  
 TIME :14:25:24 14:41:29 16 (min) Purpose code: 1  
 LOG :3478.57 3479.61 1.03 Area code : 1  
 FDEPTH: 15 20 GearCond.code:  
 BDEPTH: 50 48 Validity code:  
 Towing dir: 214e Wire out: 85 m Speed: 45 kn\*10  
 Sorted: 36 Kg Total catch: 900.00 CATCH/HOUR: 3375.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	3375.00	101719	100.00	3166
Total	3375.00		100.00	

PROJECT STATION:1892  
 DATE:23/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2910  
 start stop duration Long W 1039  
 TIME :01:06:08 01:18:23 12 (min) Purpose code: 1  
 LOG :3154.00 3154.92 0.91 Area code : 1  
 FDEPTH: 12 12 GearCond.code:  
 BDEPTH: 66 64 Validity code:  
 Towing dir: 110e Wire out: 80 m Speed: 44 kn\*10  
 Sorted: 35 Kg Total catch: 72.77 CATCH/HOUR: 363.85

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	272.50	7280	74.89	3160
Engraulis encrasicolus	80.40	5010	22.10	3161
Scomber japonicus	9.65	30	2.65	
Alloteuthis subulata	1.30	590	0.36	
Total	363.85		100.00	

PROJECT STATION:1898  
 DATE:24/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2824  
 start stop duration Long W 1134  
 TIME :20:59:33 21:13:24 14 (min) Purpose code: 1  
 LOG :3536.57 3537.42 0.85 Area code : 1  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 45 45 Validity code:  
 Towing dir: 340e Wire out: 85 m Speed: 35 kn\*10  
 Sorted: 32 Kg Total catch: 165.50 CATCH/HOUR: 709.29

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	519.64	15150	73.26	3167
Diplodus vulgaris	59.36	343	8.37	
Scomber japonicus	28.71	223	4.05	3169
Merluccius senegalensis	28.07	857	3.96	
Agellus acarne	22.07	64	3.11	
Engraulis encrasicolus	18.00	2207	2.54	3168
Alloteuthis subulata	10.07	5036	1.42	
C R A B S	7.93	536	1.12	
Diplodus bellottii	6.86	150	0.97	
Agellus bellottii	5.14	21	0.72	
Trachinus draco	2.14	21	0.30	
Scomber scombrus	1.29	9	0.18	
Total	709.28		100.00	

PROJECT STATION:1893  
 DATE:25/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2901  
 start stop duration Long W 1041  
 TIME :03:45:56 03:59:53 14 (min) Purpose code: 1  
 LOG :3173.09 3174.15 1.06 Area code : 1  
 FDEPTH: 12 12 GearCond.code:  
 BDEPTH: 56 59 Validity code:  
 Towing dir: 355e Wire out: 80 m Speed: 45 kn\*10  
 Sorted: 33 Kg Total catch: 200.45 CATCH/HOUR: 859.07

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Engraulis encrasicolus	514.29	44820	59.87	3163
Sardina pilchardus	318.86	10054	37.12	3162
Lepidopus caudatus	14.36	9	1.67	
Merluccius merluccius	11.57	231	1.35	
Total	859.08		100.01	

PROJECT STATION:1899  
 DATE:25/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 1145  
 start stop duration Long W 1145  
 TIME :00:27:51 00:57:43 30 (min) Purpose code: 1  
 LOG :3564.13 3566.13 1.97 Area code : 1  
 FDEPTH: 15 20 GearCond.code:  
 BDEPTH: 53 54 Validity code:  
 Towing dir: 350e Wire out: 80 m Speed: 40 kn\*10  
 Sorted: Kg Total catch: 0.76 CATCH/HOUR: 1.52

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
C R A B S	0.92	72	60.53	
Sardina pilchardus	0.32	10	21.05	
Engraulis encrasicolus	0.28	14	18.42	
Total	1.52		100.00	

PROJECT STATION:1894  
 DATE:23/ 5/03 GEAR TYPE: BT No: 2 POSITION:Lat N 2909  
 start stop duration Long W 1127  
 TIME :16:26:58 16:36:39 10 (min) Purpose code: 1  
 LOG :3287.73 3288.24 0.50 Area code : 1  
 FDEPTH: 136 126 GearCond.code:  
 BDEPTH: 136 126 Validity code:  
 Towing dir: 210e Wire out: 400 m Speed: 30 kn\*10  
 Sorted: 18 Kg Total catch: 61.95 CATCH/HOUR: 371.70

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Anthias anthias	326.70	14004	87.89	
Zeus faber	27.60	24	7.43	
Dentex maroccanus	6.00	6	1.61	
Dentex macrophthalmus	4.86	24	1.31	
Trachurus trachurus	3.90	54	1.05	
Peristedion cataphractum	1.20	6	0.32	
Scomber japonicus	0.84	12	0.23	
Coris julis	0.60	6	0.16	
Total	371.70		100.00	

PROJECT STATION:1900  
 DATE:25/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2858  
 start stop duration Long W 1207  
 TIME :13:57:01 14:27:13 30 (min) Purpose code: 1  
 LOG :3685.26 3686.96 1.67 Area code : 1  
 FDEPTH: 45 50 GearCond.code:  
 BDEPTH: 196 119 Validity code:  
 Towing dir: 170e Wire out: 200 m Speed: 35 kn\*10  
 Sorted: 11 Kg Total catch: 11.70 CATCH/HOUR: 23.40

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	23.40	1036	100.00	3170
Total	23.40		100.00	

PROJECT STATION:1895  
 DATE:24/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2914  
 start stop duration Long W 1046  
 TIME :01:41:04 01:41:24 27 (min) Purpose code: 1  
 LOG :3364.88 3366.70 1.79 Area code : 1  
 FDEPTH: 12 12 GearCond.code:  
 BDEPTH: 99 99 Validity code:  
 Towing dir: 67e Wire out: 80 m Speed: 45 kn\*10  
 Sorted: 35 Kg Total catch: 247.34 CATCH/HOUR: 549.64

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	332.11	3127	60.42	3163
Sardina pilchardus	129.18	2333	23.32	3165
Engraulis encrasicolus	83.69	4153	15.23	3164
Lepidopus caudatus	3.22	2	0.59	
Trachurus trachurus	2.44	2	0.44	
Total	549.64		100.00	

PROJECT STATION:1901  
 DATE:25/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2819  
 start stop duration Long W 1158  
 TIME :21:15:49 21:30:40 15 (min) Purpose code: 1  
 LOG :3749.70 3750.70 0.99 Area code : 1  
 FDEPTH: 15 15 GearCond.code:  
 BDEPTH: 48 47 Validity code:  
 Towing dir: 180e Wire out: 100 m Speed: 40 kn\*10  
 Sorted: 41 Kg Total catch: 81.38 CATCH/HOUR: 325.52

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	296.40	5704	91.05	3171
Engraulis encrasicolus	17.04	1264	5.23	3172
Scomber japonicus	9.68	112	2.97	3173
Merluccius senegalensis	1.12	8	0.34	
C R A B S	1.04	112	0.32	
Belone belone gracilis	0.24	8	0.07	
Total	325.52		99.98	

PROJECT STATION:1902  
 DATE:26/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2821 Long W 1219  
 start stop duration  
 TIME :05:17:43 05:47:37 30 (min) Purpose code: 1  
 LOG :3819.42 3821.65 2.22 Area code : 1  
 FDEPTH: 15 25 GearCond.code:  
 BDEPTH: 56 54 Validity code:  
 Towing dir: 167e Wire out: 90 m Speed: 45 kn\*10  
 Sorted: 4 Kg Total catch: 4.05 CATCH/HOUR: 8.10

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sarda sarda	8.10 20	100.00	
Total	8.10	100.00	

PROJECT STATION:1903  
 DATE:26/ 5/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2807 Long W 1218  
 start stop duration  
 TIME :08:54:59 09:09:45 14 (min) Purpose code: 1  
 LOG :3847.02 3847.75 0.71 Area code : 1  
 FDEPTH: 39 39 GearCond.code:  
 BDEPTH: 39 39 Validity code:  
 Towing dir: 75e Wire out: 150 m Speed: 30 kn\*10  
 Sorted: 37 Kg Total catch: 112.66 CATCH/HOUR: 482.83

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	249.56 51883	51.69	3174
Merluccius senegalensis	130.50 2751	27.03	
Engraulis encrasicolus	90.64 19046	18.77	3175
Scomber japonicus	7.50 47	1.55	
Solea vulgaris	1.93 26	0.40	
Alloteuthis subulata	0.77 244	0.16	
Trisopterus luscus	0.64 64	0.13	
Loligo vulgaris	0.51 39	0.11	
Lesueurigobius sanzoi	0.26 154	0.05	
Spondyliosoma cantharus	0.26 13	0.05	
Trachurus trachurus	0.13 13	0.03	
Ubrina canariensis	0.13 13	0.03	
Total	482.83	100.00	

PROJECT STATION:1904  
 DATE:26/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2808 Long W 1237  
 start stop duration  
 TIME :15:43:35 15:58:10 15 (min) Purpose code: 1  
 LOG :3907.14 3908.11 0.97 Area code : 1  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 53 52 Validity code:  
 Towing dir: 184e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 34 Kg Total catch: 1462.00 CATCH/HOUR: 5848.00

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Scomber japonicus	5848.00 59684	100.00	3176
Total	5848.00	100.00	

PROJECT STATION:1905  
 DATE:27/ 5/03 GEAR TYPE: PT No: 7 POSITION:Lat N 2757 Long W 1259  
 start stop duration  
 TIME :21:51:29 22:05:17 14 (min) Purpose code: 1  
 LOG :4179.29 4180.06 1.09 Area code : 2  
 FDEPTH: 15 15 GearCond.code:  
 BDEPTH: 38 35 Validity code:  
 Towing dir: 305e Wire out: 85 m Speed: 33 kn\*10  
 Sorted: 29 Kg Total catch: 61.32 CATCH/HOUR: 262.80

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	248.40 38374	94.52	3177
Merluccius senegalensis	7.37 90	2.80	
Scomber japonicus	3.17 94	1.21	
Engraulis encrasicolus	1.89 574	0.72	3178
Belone belone gracilis	1.71 26	0.65	
Trachurus trachurus	0.26 9	0.10	
Total	262.80	100.00	

PROJECT STATION:1906  
 DATE:28/ 5/03 GEAR TYPE: PT No: 5 POSITION:Lat N 2751 Long W 1309  
 start stop duration  
 TIME :02:12:19 02:43:59 32 (min) Purpose code: 1  
 LOG :4217.60 4219.74 2.11 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 48 56 Validity code:  
 Towing dir: 323e Wire out: 150 m Speed: 40 kn\*10  
 Sorted: 36 Kg Total catch: 35.96 CATCH/HOUR: 67.43

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Engraulis encrasicolus	52.50 11696	77.86	3179
Sardina pilchardus	14.48 2503	21.47	3178
Illex coindetii	0.45 141	0.67	
Total	67.43	100.00	

PROJECT STATION:1907  
 DATE:28/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2742 Long W 1316  
 start stop duration  
 TIME :06:48:40 07:04:28 16 (min) Purpose code: 1  
 LOG :4256.36 4257.31 0.94 Area code : 1  
 FDEPTH: 20 20 GearCond.code:  
 BDEPTH: 42 41 Validity code:  
 Towing dir: 20e Wire out: 110 m Speed: 35 kn\*10  
 Sorted: 5 Kg Total catch: 5.59 CATCH/HOUR: 20.96

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	14.66 533	69.94	3180
Scomber japonicus	6.30 461	30.06	3181
Total	20.96	100.00	

PROJECT STATION:1908  
 DATE:29/ 5/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2742 Long W 1316  
 start stop duration  
 TIME :08:13:15 08:41:32 28 (min) Purpose code: 1  
 LOG :4262.19 4263.86 1.66 Area code : 1  
 FDEPTH: 42 43 GearCond.code:  
 BDEPTH: 42 43 Validity code:  
 Towing dir: 25e Wire out: 35 m Speed:160 kn\*10  
 Sorted: 24 Kg Total catch: 24.69 CATCH/HOUR: 52.91

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	35.68 821	67.44	3182
Octopus vulgaris	5.46 2	10.32	
Pagellus acarne	3.79 19	7.16	
Spondyliosoma cantharus	3.28 17	6.20	
Alloteuthis subulata	1.37 469	2.59	
Pagrus pagrus	0.73 2	1.38	
Aspitriglia obscura	0.62 6	1.17	
Sepia officinalis hierredda	0.54 2	1.02	
Trachurus trachurus	0.49 6	0.93	
Merluccius senegalensis	0.30 2	0.57	
Scomber japonicus	0.30 2	0.57	
Trachinus draco	0.21 2	0.40	
Loligo vulgaris	0.09 24	0.17	
Arnoglossus imperialis	0.04 11	0.08	
Total	52.90	100.00	

PROJECT STATION:1909  
 DATE:28/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2731 Long W 1321  
 start stop duration  
 TIME :12:39:18 13:09:15 30 (min) Purpose code: 1  
 LOG :4301.38 4303.50 2.10 Area code : 2  
 FDEPTH: 15 30 GearCond.code:  
 BDEPTH: 41 60 Validity code:  
 Towing dir: 273e Wire out: 150 m Speed: 40 kn\*10  
 Sorted: 36 Kg Total catch: 35.78 CATCH/HOUR: 71.56

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	69.50 1930	97.12	3183
Octopus vulgaris	1.28 2	1.79	
Scomber japonicus	0.78 12	1.09	
Total	71.56	100.00	

PROJECT STATION:1910  
 DATE:28/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2719 Long W 1339  
 start stop duration  
 TIME :17:56:30 18:23:20 27 (min) Purpose code: 1  
 LOG :4348.76 4350.43 1.66 Area code : 1  
 FDEPTH: 45 35 GearCond.code:  
 BDEPTH: 103 282 Validity code:  
 Towing dir: 297e Wire out: 165 m Speed: 35 kn\*10  
 Sorted: 36 Kg Total catch: 0.27 CATCH/HOUR: 0.60

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Scomber japonicus	0.60 29	100.00	
Total	0.60	100.00	

PROJECT STATION:1911  
 DATE:28/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2717 Long W 1331  
 start stop duration  
 TIME :21:41:56 22:06:42 25 (min) Purpose code: 1  
 LOG :4379.36 4380.80 1.44 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 73 72 Validity code:  
 Towing dir: 215e Wire out: 100 m Speed: 35 kn\*10  
 Sorted: 36 Kg Total catch: 714.20 CATCH/HOUR: 1714.08

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	1708.80 16978	99.69	3184
Scomber japonicus	5.28 41	0.31	3185
Total	1714.08	100.00	

PROJECT STATION:1912  
 DATE:29/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2649 Long W 1333  
 start stop duration  
 TIME :09:23:23 10:03:03 40 (min) Purpose code: 1  
 LOG :4487.38 4490.10 2.70 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 28 27 Validity code:  
 Towing dir: 25e Wire out: 100 m Speed: 40 kn\*10  
 Sorted: 35 Kg Total catch: 1507.98 CATCH/HOUR: 2261.97

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	2235.00 23357	98.81	3186
Engraulis encrasicolus	15.00 3000	0.66	3187
Scomber japonicus	7.08 27	0.31	3188
Trichurus lepturus	1.88 5	0.08	
Trachurus trachurus	1.22 8	0.05	
Sphyræna sphyraena	1.01 3	0.04	
Scomber scombrus	0.50 2	0.02	
Sardinella aurata	0.30 2	0.01	
Total	2261.99	99.98	

PROJECT STATION:1913  
 DATE:29/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2637 Long W 1356  
 start stop duration  
 TIME :17:13:23 17:36:28 23 (min) Purpose code: 1  
 LOG :4558.56 4559.95 1.40 Area code : 2  
 FDEPTH: 15 15 GearCond.code:  
 BDEPTH: 43 42 Validity code:  
 Towing dir: 110e Wire out: 100 m Speed: 40 kn\*10  
 Sorted: 32 Kg Total catch: 106.10 CATCH/HOUR: 276.78

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella aurata	251.61 673	90.91	3189
Scomber japonicus	19.96 76	7.21	3190
Sardinella maderensis	5.22 10	1.89	3191
Total	276.79	100.01	

PROJECT STATION:1914  
 DATE:30/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2610  
 start stop duration Long W 1438  
 TIME :09:34:00 09:52:29 18 (min) Purpose code: 1  
 LOG :4705.07 4706.25 1.18 Area code : 2  
 FDEPTH: 5 5 GearCond.code:  
 BDEPTH: 61 86 Validity code:  
 Towing dir: 295e Wire out: 100 m Speed: 35 kn\*10  
 Sorted: Kg Total catch: 0.11 CATCH/HOUR: 0.37

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	0.37	3	100.00	
Total	0.37		100.00	

PROJECT STATION:1915  
 DATE:30/ 5/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2602  
 start stop duration Long W 1438  
 TIME :11:59:51 12:13:22 14 (min) Purpose code: 1  
 LOG :4722.64 4723.45 0.80 Area code : 2  
 FDEPTH: 10 15 GearCond.code:  
 BDEPTH: 51 58 Validity code:  
 Towing dir: 155e Wire out: 100 m Speed: 40 kn\*10  
 Sorted: 35 Kg Total catch: 1857.65 CATCH/HOUR: 7961.36

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	7961.36	64963	100.00	3193
Total	7961.36		100.00	

PROJECT STATION:1916  
 DATE:30/ 5/03 GEAR TYPE: PT No: 2 POSITION:Lat N 2559  
 start stop duration Long W 1443  
 TIME :14:14:07 14:37:46 24 (min) Purpose code: 1  
 LOG :4740.95 4742.49 1.55 Area code : 2  
 FDEPTH: 25 35 GearCond.code:  
 BDEPTH: 83 70 Validity code:  
 Towing dir: 112e Wire out: 200 m Speed: 40 kn\*10  
 Sorted: 33 Kg Total catch: 930.00 CATCH/HOUR: 2075.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1875.00	16313	90.36	3194
Scomber japonicus	200.00	1063	9.64	3195
Total	2075.00		100.00	

PROJECT STATION:1917  
 DATE:30/ 5/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2601  
 start stop duration Long W 1505  
 TIME :17:36:11 18:06:30 30 (min) Purpose code: 1  
 LOG :4771.05 4772.76 1.70 Area code : 2  
 FDEPTH: 208 218 GearCond.code:  
 BDEPTH: 208 218 Validity code:  
 Towing dir: 40e Wire out: 600 m Speed: 34 kn\*10  
 Sorted: 30 Kg Total catch: 524.96 CATCH/HOUR: 1049.92

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Lepidopus caudatus	470.40	816	44.80	
Dentex macropthalmus	239.00	2660	22.76	
Trachurus trachurus	172.40	1752	16.42	3197
Dentex maroccanus	52.50	520	5.00	
Zeus faber	33.20	24	3.16	
Merluccius merluccius	23.40	32	2.23	
Sphoeroides pachygaster	20.72	12	1.97	
Pagellus acarne	10.10	40	0.96	
Trachurus picturatus	9.18	44	0.87	3198
Scomber japonicus	7.18	30	0.68	3196
Dasyatis pastinaca	4.46	2	0.42	
Mullus surmuletus	2.98	10	0.28	
Illex coindetii	2.20	26	0.21	
Zenopsis conchifer	1.82	2	0.17	
Macrorhamphosus scolopax	0.50	30	0.05	
Total	1050.04		99.98	

PROJECT STATION:1918  
 DATE:31/ 5/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2542  
 start stop duration Long W 1458  
 TIME :01:12:11 01:40:17 28 (min) Purpose code: 1  
 LOG :4840.00 4841.47 1.46 Area code : 2  
 FDEPTH: 94 93 GearCond.code:  
 BDEPTH: 94 93 Validity code:  
 Towing dir: 121e Wire out: 300 m Speed: 30 kn\*10  
 Sorted: 28 Kg Total catch: 27.93 CATCH/HOUR: 59.85

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	29.04	422	48.52	3199
Pagellus bellottii	9.62	64	16.07	
Aspitrigla obscura	5.36	79	8.96	
Zeus faber	3.39	2	5.66	
Pagellus erythrinus	3.26	4	5.45	
Ophidion barbatum	1.91	105	3.19	
Umbrina cirrosa	1.41	2	2.36	
Mullus barbatus	1.16	4	1.94	
Spondyliosoma cantharus	1.14	6	1.90	
Dicologoglossa cuneata	1.09	15	1.82	
Illex coindetii	1.01	30	1.69	
Echelus myrus	0.90	21	1.50	
Macrorhamphosus scolopax	0.24	13	0.40	
Sepiella rondeletii	0.24	26	0.40	
Scomber japonicus	0.11	2	0.18	
Total	59.88		100.04	

PROJECT STATION:1919  
 DATE: 4/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2537  
 start stop duration Long W 1512  
 TIME :09:32:46 10:01:28 29 (min) Purpose code: 1  
 LOG :5177.18 5178.73 1.54 Area code : 2  
 FDEPTH: 93 97 GearCond.code:  
 BDEPTH: 93 97 Validity code:  
 Towing dir: 305e Wire out: 270 m Speed: 33 kn\*10  
 Sorted: 88 Kg Total catch: 87.85 CATCH/HOUR: 181.76

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	148.97	2166	81.96	3200
Lagocephalus laevis	20.57	17	11.32	
Zeus faber	7.57	6	4.16	
Pagellus bellottii	1.61	8	0.89	
Aspitrigla obscura	1.10	21	0.61	
Trachinus vipera	1.08	17	0.59	
Spondyliosoma cantharus	0.43	2	0.24	
Pagellus acarne	0.39	2	0.21	
Scomber japonicus	0.17	4	0.09	
Total	181.89		100.07	

PROJECT STATION:1920  
 DATE: 4/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2532  
 start stop duration Long W 1502  
 TIME :12:08:28 12:36:57 28 (min) Purpose code: 1  
 LOG :5194.55 5196.26 1.68 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 86 88 Validity code:  
 Towing dir: 300e Wire out: 145 m Speed: 35 kn\*10  
 Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
N O C A T C H			0.00	

PROJECT STATION:1921  
 DATE: 4/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2517  
 start stop duration Long W 1451  
 TIME :16:31:52 17:00:48 29 (min) Purpose code: 1  
 LOG :5226.13 5227.69 1.52 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 52 54 Validity code:  
 Towing dir: 358e Wire out: 150 m Speed: 32 kn\*10  
 Sorted: 36 Kg Total catch: 563.85 CATCH/HOUR: 1166.59

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1135.86	11793	97.37	3202
Scomber japonicus	17.28	58	1.48	3201
Trichiurus lepturus	13.45	6	1.15	
Total	1166.59		100.00	

PROJECT STATION:1922  
 DATE: 4/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2522  
 start stop duration Long W 1503  
 TIME :19:10:30 19:42:40 32 (min) Purpose code: 1  
 LOG :5246.24 5248.37 2.11 Area code : 2  
 FDEPTH: 30 30 GearCond.code:  
 BDEPTH: 68 65 Validity code:  
 Towing dir: 115e Wire out: 125 m Speed: 39 kn\*10  
 Sorted: Kg Total catch: 0.37 CATCH/HOUR: 0.69

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	0.38	4	55.07	
Scomber japonicus	0.32	2	46.38	
Total	0.70		101.45	

PROJECT STATION:1923  
 DATE: 5/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2518  
 start stop duration Long W 1519  
 TIME :03:47:38 04:17:09 30 (min) Purpose code: 1  
 LOG :5330.96 5332.63 1.65 Area code : 2  
 FDEPTH: 79 80 GearCond.code:  
 BDEPTH: 79 80 Validity code:  
 Towing dir: 300e Wire out: 250 m Speed: 30 kn\*10  
 Sorted: 85 Kg Total catch: 394.90 CATCH/HOUR: 789.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	525.88	8640	66.58	3204
Pagellus acarne	111.10	484	14.07	
Scomber japonicus	51.80	1108	6.56	3203
Pagellus bellottii	41.26	154	5.22	
Trichiurus lepturus	28.30	20	3.58	
Spondyliosoma cantharus	7.36	44	0.93	
Trachinus draco	7.14	110	0.90	
Aspitrigla obscura	6.38	98	0.81	
Pomadourus incisus	3.08	10	0.39	
Merluccius merluccius	2.98	4	0.38	
Dentex macropthalmus	2.52	54	0.32	
Octopus vulgaris	1.40	2	0.18	
Zeus faber	0.24	2	0.03	
Dentex maroccanus	0.22	10	0.03	
Microchirus sp.	0.22	32	0.03	
Total	789.88		100.01	

PROJECT STATION:1924  
 DATE: 5/ 6/03 GEAR TYPE: PT No: 6 POSITION:Lat N 2507  
 start stop duration Long W 1457  
 TIME :07:30:04 07:41:32 11 (min) Purpose code: 1  
 LOG :5361.21 5361.88 0.67 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 40 43 Validity code:  
 Towing dir: 300e Wire out: 145 m Speed: 36 kn\*10  
 Sorted: 34 Kg Total catch: 2229.50 CATCH/HOUR: 12160.91

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1170.91	11873	96.79	3205
Scomber japonicus	390.00	1064	3.21	
Total	12160.91		100.00	

PROJECT STATION:1925  
 DATE: 5/ 6/03 GEAR TYPE: PT No: 6 POSITION: Lat N 2458 Long W 1459  
 start stop duration  
 TIME :10:57:31 11:09:01 12 (min) Purpose code: 1  
 LOG :5390.80 5391.59 0.78 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 37 36 Validity code:  
 Towing dir: 111e Wire out: 135 m Speed: 40 kn\*10  
 Sorted: 34 Kg Total catch: 818.70 CATCH/HOUR: 4093.50

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	4087.50	41375	99.85
Scomber japonicus	6.00	30	0.15
Total	4093.50	100.00	

PROJECT STATION:1929  
 DATE: 6/ 6/03 GEAR TYPE: BT No: 9 POSITION: Lat N 2502 Long W 1611  
 start stop duration  
 TIME :14:47:35 15:17:43 30 (min) Purpose code: 1  
 LOG :5645.81 5647.36 1.53 Area code : 2  
 FDEPTH: 242 232 GearCond.code:  
 BDEPTH: 242 232 Validity code:  
 Towing dir: 30e Wire out: 660 m Speed: 30 kn\*10  
 Sorted: Kg Total catch: 157.50 CATCH/HOUR: 315.00

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Dentex macrophthalmus	144.50	1470	45.87
Merluccius merluccius	86.30	204	27.40
Zenopsis conchifer	32.60	70	10.35
Lepidopus caudatus	17.50	124	5.56
Trachurus trachurus	13.70	112	4.35
Zeus faber	4.32	38	1.43
Illex coindetii	3.12	60	0.99
Sphoeroides pachgaster	1.88	4	0.60
Scyllorhinus canicula	1.52	12	0.48
Scorpaena scrofa	1.44	48	0.46
Scorpaena sp.	1.26	6	0.40
Shrimps, small, non comm.	1.14	726	0.36
Mullus surmuletus	1.04	2	0.33
Capros aper	1.00	110	0.32
Pagellus acarne	0.84	2	0.27
Scorpaena scrofa	0.82	542	0.26
Citharus linguatula	0.58	12	0.18
Raja miraletus	0.48	2	0.15
Scomber japonicus	0.48	2	0.15
Peristedion cataphractum	0.10	8	0.03
Rossia macrosomia	0.06	2	0.02
Sepia officinalis hierredda	0.06	4	0.02
Aspitrigla obscura	0.04	2	0.01
Macrorhamphosus scolopax	0.02	2	0.01
Total	315.00	100.00	

PROJECT STATION:1926  
 DATE: 6/ 6/03 GEAR TYPE: BT No: 9 POSITION: Lat N 2454 Long W 1517  
 start stop duration  
 TIME :00:41:06 01:09:50 29 (min) Purpose code: 1  
 LOG :5518.16 5519.86 1.68 Area code : 2  
 FDEPTH: 37 36 GearCond.code:  
 BDEPTH: 37 36 Validity code:  
 Towing dir: 295e Wire out: 200 m Speed: 30 kn\*10  
 Sorted: 80 Kg Total catch: 348.20 CATCH/HOUR: 720.41

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Diplodus bellottii	358.45	4303	49.76
Trachurus trachurus	186.72	3848	25.92
Pagellus acarne	61.76	341	8.57
Plectorhynchus mediterraneus	32.48	72	4.51
Spondyliosoma cantharus	18.62	145	2.58
Pagellus bellottii	13.76	124	1.91
Ubrina canariensis	11.90	41	1.65
Octopus vulgaris	7.86	6	1.09
Raja sp.	7.14	2	0.99
Scomber japonicus	6.77	46	0.94
Sardina pilchardus	3.93	46	0.55
Trachinus draco	3.83	62	0.53
Pomadasy inciscus	3.72	21	0.52
Aspitrigla obscura	1.45	21	0.20
Loligo vulgaris	1.22	6	0.17
Microchirus variegatus	0.72	124	0.10
Total	720.33	99.99	

PROJECT STATION:1930  
 DATE: 6/ 6/03 GEAR TYPE: PT No: 6 POSITION: Lat N 2437 Long W 1529  
 start stop duration  
 TIME :21:32:34 21:36:11 4 (min) Purpose code: 1  
 LOG :5704.24 5704.48 0.24 Area code : 2  
 FDEPTH: 5 5 GearCond.code:  
 BDEPTH: 31 30 Validity code:  
 Towing dir: 295e Wire out: 110 m Speed: 39 kn\*10  
 Sorted: 33 Kg Total catch: 491.70 CATCH/HOUR: 7375.50

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	5885.75	56700	79.77
Scomber japonicus	981.00	5175	13.30
Spondyliosoma cantharus	317.25	1125	4.30
Pagellus bellottii	78.75	450	1.07
Trachurus lepturus	45.00	15	0.61
Diplodus bellottii	38.25	450	0.52
Pomadasy jubelini	31.50	225	0.43
Total	7375.50	100.00	

PROJECT STATION:1927  
 DATE: 6/ 6/03 GEAR TYPE: BT No: 9 POSITION: Lat N 2446 Long W 1500  
 start stop duration  
 TIME :03:36:04 04:05:50 30 (min) Purpose code: 1  
 LOG :5542.10 5543.82 1.53 Area code : 2  
 FDEPTH: 28 30 GearCond.code:  
 BDEPTH: 28 30 Validity code:  
 Towing dir: 295e Wire out: 200 m Speed: 30 kn\*10  
 Sorted: 68 Kg Total catch: 371.02 CATCH/HOUR: 742.04

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Diplodus vulgaris	291.50	4082	39.28
Pomadasy inciscus	100.50	754	13.54
Pagellus bellottii	86.50	962	11.66
Pagellus acarne	67.90	310	9.15
Trachurus trachurus	67.30	1210	9.07
Plectorhynchus mediterraneus	38.50	70	5.19
Octopus vulgaris	17.80	14	2.40
Sardina pilchardus	17.20	150	2.32
Trachurus lepturus	16.30	4	2.20
Spondyliosoma cantharus	11.70	80	1.58
Trachinus draco	10.20	130	1.37
Scomber japonicus	5.54	28	0.75
Aspitrigla obscura	3.90	50	0.53
Conger conger	3.40	2	0.46
Raja sp.	2.90	2	0.39
Loligo vulgaris	0.50	4	0.07
Solea vulgaris	0.40	20	0.05
Total	742.04	100.01	

PROJECT STATION:1931  
 DATE: 7/ 6/03 GEAR TYPE: PT No: 4 POSITION: Lat N 2415 Long W 1554  
 start stop duration  
 TIME :14:51:07 15:02:05 11 (min) Purpose code: 1  
 LOG :5875.07 5875.73 0.65 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 33 33 Validity code:  
 Towing dir: 108e Wire out: 140 m Speed: 38 kn\*10  
 Sorted: 37 Kg Total catch: 3056.31 CATCH/HOUR: 16670.78

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	16479.82	194329	98.85
Scomber japonicus	181.15	987	1.09
Spondyliosoma cantharus	9.82	33	0.06
Total	16670.79	100.00	

PROJECT STATION:1932  
 DATE: 8/ 6/03 GEAR TYPE: PT No: 4 POSITION: Lat N 2416 Long W 1616  
 start stop duration  
 TIME :02:13:49 02:34:17 20 (min) Purpose code: 1  
 LOG :5974.59 5975.96 1.35 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 65 65 Validity code:  
 Towing dir: 300e Wire out: 140 m Speed: 40 kn\*10  
 Sorted: 36 Kg Total catch: 287.55 CATCH/HOUR: 862.65

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Scomber japonicus	859.20	20616	99.60
Prionace glauca	3.45	3	0.40
Total	862.65	100.00	

PROJECT STATION:1928  
 DATE: 6/ 6/03 GEAR TYPE: PT No: 6 POSITION: Lat N 2442 Long W 1502  
 start stop duration  
 TIME :06:20:47 06:32:31 12 (min) Purpose code: 1  
 LOG :5562.54 5563.27 0.72 Area code : 2  
 FDEPTH: 5 5 GearCond.code:  
 BDEPTH: 28 27 Validity code:  
 Towing dir: 75e Wire out: 120 m Speed: 38 kn\*10  
 Sorted: 20 Kg Total catch: 3000.00 CATCH/HOUR: 15000.00

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	14725.00	145695	98.17
Scomber japonicus	212.50	425	1.42
Spondyliosoma cantharus	63.00	210	0.42
Total	15000.50	100.01	

PROJECT STATION:1933  
 DATE: 8/ 6/03 GEAR TYPE: PT No: 4 POSITION: Lat N 2409 Long W 1601  
 start stop duration  
 TIME :04:48:29 04:55:24 7 (min) Purpose code: 1  
 LOG :5994.95 5995.42 0.46 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 38 38 Validity code:  
 Towing dir: 300e Wire out: 135 m Speed: 40 kn\*10  
 Sorted: 36 Kg Total catch: 1098.34 CATCH/HOUR: 9414.34

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardina pilchardus	9385.71	120086	99.70
Scomber japonicus	12.09	69	0.13
Spondyliosoma cantharus	6.51	34	0.07
Trachurus trachurus	3.86	86	0.04
Diplodus bellottii	2.91	34	0.03
Pomadasy inciscus	2.83	17	0.03
Trachurus trachurus	1.20	34	0.01
Total	9415.11	100.01	



PROJECT STATION:1934  
 DATE: 8/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2401  
 start stop duration Long W 1632  
 TIME :14:58:38 15:13:16 15 (min) Purpose code: 1  
 LOG :6099.69 6100.47 0.78 Area code : 2  
 FDEPTH: 69 68 GearCond.code:  
 BDEPTH: 69 68 Validity code:  
 Towing dir: 300e Wire out: 210 m Speed: 30 kn\*10  
 Sorted: 61 Kg Total catch: 447.52 CATCH/HOUR: 1790.08

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	832.00	18348	46.48	3224
Scomber japonicus	681.20	23856	38.05	3226
Trachurus trecae	162.76	3848	9.09	3225
Scomber japonicus	97.00	108	5.42	3227
Boops boops	3.36	44	0.19	
Zeus faber	2.92	4	0.16	
Scyliorhinus canicula	2.72	4	0.15	
Dentex gibbosus	2.08	4	0.12	
Spondyliosoma cantharus	1.84	8	0.10	
Dentex canariensis	1.56	4	0.09	
Diplodus vulgaris	1.08	4	0.06	
Pagellus bellottii	1.04	4	0.06	
Pagellus acarne	0.52	4	0.03	
Total	1790.08		100.00	

PROJECT STATION:1939  
 DATE: 9/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2328  
 start stop duration Long W 1628  
 TIME :12:47:36 13:21:18 34 (min) Purpose code: 1  
 LOG :6301.44 6303.12 1.66 Area code : 2  
 FDEPTH: 34 35 GearCond.code:  
 BDEPTH: 34 35 Validity code:  
 Towing dir: 112e Wire out: 200 m Speed: 30 kn\*10  
 Sorted: 84 Kg Total catch: 719.78 CATCH/HOUR: 1270.20

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	711.18	18842	55.99	3235
Trachurus trecae	443.82	12025	34.94	3236
Diplodus bellottii	41.47	44	3.26	
Spondyliosoma cantharus	16.06	141	1.26	
Sardina pilchardus	16.06	229	1.26	
Pomadasys incisus	12.53	35	0.99	
Raja undulata	12.53	5	0.99	
Octopus vulgaris	5.15	4	0.41	
Pagellus acarne	4.59	18	0.36	
Scyliorhinus canicula	2.15	4	0.17	
Scomber japonicus	1.99	12	0.16	3237
Sepia officinalis hierredda	1.57	2	0.12	
Boops boops	0.88	18	0.07	
Loligo vulgaris	0.12	2	0.01	
Aspitranga obscura	0.09	2	0.01	
Total	1270.19		100.00	

PROJECT STATION:1935  
 DATE: 8/ 6/03 GEAR TYPE: FT No: 4 POSITION:Lat N 2352  
 start stop duration Long W 1612  
 TIME :17:50:44 18:01:38 11 (min) Purpose code: 1  
 LOG :6124.27 6124.96 0.68 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 43 43 Validity code:  
 Towing dir: 300e Wire out: 145 m Speed: 40 kn\*10  
 Sorted: 31 Kg Total catch: 4601.00 CATCH/HOUR: 25096.36

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	25096.36	324736	100.00	3228
Total	25096.36		100.00	

PROJECT STATION:1940  
 DATE: 9/ 6/03 GEAR TYPE: FT No: 4 POSITION:Lat N 2352  
 start stop duration Long W 1635  
 TIME :14:50:51 15:19:36 29 (min) Purpose code: 1  
 LOG :6315.91 6317.81 1.88 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 41 37 Validity code:  
 Towing dir: 112e Wire out: 130 m Speed: 40 kn\*10  
 Sorted: 24 Kg Total catch: 1780.95 CATCH/HOUR: 3684.72

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	2863.45	36579	77.71	3238
Scomber japonicus	817.66	6124	22.19	3239
Sardinella aurita	3.62	23	0.10	3240
Total	3684.73		100.00	

PROJECT STATION:1936  
 DATE: 8/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2339  
 start stop duration Long W 1604  
 TIME :21:18:25 21:33:15 15 (min) Purpose code: 1  
 LOG :6154.90 6155.68 0.79 Area code : 2  
 FDEPTH: 27 27 GearCond.code:  
 BDEPTH: 27 27 Validity code:  
 Towing dir: 350e Wire out: 120 m Speed: 32 kn\*10  
 Sorted: 70 Kg Total catch: 366.97 CATCH/HOUR: 1467.88

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Diplodus bellottii	499.00	6560	33.99	
Electorhynchus mediterraneus	311.00	360	21.19	
Pomadasys incisus	238.00	1520	16.21	
Pagellus bellottii	88.80	580	6.05	
Trachurus trachurus	55.80	920	3.80	3230
Sardina pilchardus	52.00	360	3.54	3229
Raja undulata	40.00	12	2.73	
Pagrus caeruleostictus	38.80	60	2.64	
Diplodus puntazzo	27.60	20	1.88	
Diplodus vulgaris	26.60	40	1.81	
Scomber japonicus	23.80	120	1.62	
Pagrus auriga	13.68	12	0.93	
Umbra canariensis	11.80	20	0.80	
Spondyliosoma cantharus	11.20	200	0.76	
Zeus faber	8.00	4	0.55	
Dentex canariensis	7.00	20	0.48	
Lithognathus mormyrus	6.00	20	0.41	
Mullus surmuletus	5.40	20	0.37	
Boops boops	3.40	80	0.23	
Total	1467.88		99.99	

PROJECT STATION:1941  
 DATE: 9/ 6/03 GEAR TYPE: BT No: 9 POSITION:Lat N 2335  
 start stop duration Long W 1657  
 TIME :18:17:58 18:46:19 28 (min) Purpose code: 1  
 LOG :6345.39 6346.88 1.48 Area code : 2  
 FDEPTH: 176 188 GearCond.code:  
 BDEPTH: 176 188 Validity code:  
 Towing dir: 33e Wire out: 500 m Speed: 30 kn\*10  
 Sorted: Kg Total catch: 139.82 CATCH/HOUR: 299.61

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex macrophthalmus	57.32	508	19.13	
Scyliorhinus canicula	53.36	154	17.81	
Zenopsis conchifer	50.14	62	16.74	
Merluccius senegalensis	27.64	17	9.23	
Zeus faber	23.57	13	7.87	
Lagocephalus laeigatus	19.50	19	6.51	
Dentex macracanthus	19.29	88	6.44	
Macrorhamphosus scolopax	17.66	864	5.89	
Raja naevus	10.29	9	3.43	
Mullus surmuletus	7.61	15	2.54	
Lepidopus caudatus	6.00	9	2.00	
Pagellus acarne	2.36	9	0.79	
Capros aper	1.78	60	0.59	
Scorpaena scrofa	1.50	2	0.50	
Trachurus trachurus	0.86	2	0.29	
Raja montagui	0.54	2	0.18	
Loligo vulgaris	0.21	2	0.07	
Total	299.63		100.01	

PROJECT STATION:1937  
 DATE: 9/ 6/03 GEAR TYPE: FT No: 1 POSITION:Lat N 2342  
 start stop duration Long W 1639  
 TIME :05:00:22 05:28:28 28 (min) Purpose code: 1  
 LOG :6229.81 6231.95 2.13 Area code : 2  
 FDEPTH: 25 25 GearCond.code:  
 BDEPTH: 64 70 Validity code:  
 Towing dir: 290e Wire out: 100 m Speed: 45 kn\*10  
 Sorted: 83 Kg Total catch: 83.82 CATCH/HOUR: 179.61

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	172.71	5259	96.16	3231
Trachurus trecae	3.84	88	2.14	3233
Trachurus lepturus	2.46	2	1.37	
Trachurus trachurus	0.60	9	0.33	3232
Total	179.61		100.00	

PROJECT STATION:1942  
 DATE: 9/ 6/03 GEAR TYPE: FT No: 4 POSITION:Lat N 2319  
 start stop duration Long W 1633  
 TIME :23:10:41 23:16:42 6 (min) Purpose code: 1  
 LOG :6384.68 6385.08 0.39 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 37 37 Validity code:  
 Towing dir: 300e Wire out: 108 m Speed: 39 kn\*10  
 Sorted: 36 Kg Total catch: 268.19 CATCH/HOUR: 2681.90

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	2560.00	34400	95.45	3241
Trachurus trachurus	98.40	2640	3.67	3242
Scomber japonicus	19.50	80	0.73	
Spondyliosoma cantharus	3.00	10	0.11	
Pagellus bellottii	1.00	10	0.04	
Total	2681.90		100.00	

PROJECT STATION:1938  
 DATE: 9/ 6/03 GEAR TYPE: FT No: 7 POSITION:Lat N 2330  
 start stop duration Long W 1608  
 TIME :09:20:36 09:25:43 5 (min) Purpose code: 1  
 LOG :6267.79 6268.10 0.30 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 28 28 Validity code:  
 Towing dir: 306e Wire out: 110 m Speed: 33 kn\*10  
 Sorted: 30 Kg Total catch: 90.00 CATCH/HOUR: 1080.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1080.00	9468	100.00	3234
Total	1080.00		100.00	

PROJECT STATION:1943  
 DATE:10/ 6/03 GEAR TYPE: FT No: 7 POSITION:Lat N 2307  
 start stop duration Long W 1626  
 TIME :03:37:57 03:57:13 19 (min) Purpose code: 1  
 LOG :6426.94 6428.28 1.33 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 28 27 Validity code:  
 Towing dir: 112e Wire out: 130 m Speed: 40 kn\*10  
 Sorted: 37 Kg Total catch: 334.14 CATCH/HOUR: 1055.18

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1051.58	12875	99.66	3243
Pomadasys incisus	2.05	6	0.19	
Scomber japonicus	1.36	6	0.13	
Trachurus trachurus	0.19	3	0.02	
Total	1055.18		100.00	

PROJECT STATION:1944  
 DATE:10/ 6/03 GEAR TYPE: PT No: 5 POSITION:Lat N 2248  
 start stop duration Long W 1642  
 TIME :16:53:06 17:09:17 16 (min) Purpose code: 1  
 LOG :6557.04 6558.23 1.16 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 51 51 Validity code:  
 Towing dir: 110e Wire out: 120 m Speed: 44 kn\*10  
 Sorted: 37 Kg Total catch: 1098.00 CATCH/HOUR: 4117.50

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	4117.50	79425	100.00	3244
Scomber japonicus	1.13	8	0.03	
Total	4118.63		100.03	

PROJECT STATION:1945  
 DATE:10/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2242  
 start stop duration Long W 1702  
 TIME :22:46:46 22:49:38 3 (min) Purpose code: 1  
 LOG :6611.91 6612.09 0.18 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 71 71 Validity code:  
 Towing dir: 289e Wire out: 130 m Speed: 36 kn\*10  
 Sorted: 33 Kg Total catch: 668.00 CATCH/HOUR: 13360.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	10720.00	34800	80.24	3247
Scomber japonicus	1704.00	14800	12.75	3246
Trachurus trecae	796.00	25600	5.96	3245
Sardinella maderensis	140.00	400	1.05	
Total	13360.00		100.00	

PROJECT STATION:1946  
 DATE:11/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2238  
 start stop duration Long W 1647  
 TIME :01:04:10 01:13:06 9 (min) Purpose code: 1  
 LOG :6630.16 6630.79 0.62 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 45 47 Validity code:  
 Towing dir: 280e Wire out: 120 m Speed: 41 kn\*10  
 Sorted: 42 Kg Total catch: 363.72 CATCH/HOUR: 2424.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	1920.00	43520	79.18	3248
Trachurus trecae	237.33	6773	9.79	3250
Trichurus lepturus	182.67	147	7.53	
Scomber japonicus	61.33	373	2.53	3251
Sardinella aurita	23.47	127	0.97	3249
Total	2424.80		100.00	

PROJECT STATION:1947  
 DATE:11/ 6/03 GEAR TYPE: PT No: 7 POSITION:Lat N 2222  
 start stop duration Long W 1631  
 TIME :04:39:58 04:51:18 11 (min) Purpose code: 1  
 LOG :6664.61 6665.36 0.75 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 20 21 Validity code:  
 Towing dir: 20e Wire out: 100 m Speed: 40 kn\*10  
 Sorted: 37 Kg Total catch: 523.64 CATCH/HOUR: 2856.22

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	2329.09	14280	81.54	3252
Sardina pilchardus	473.45	37953	16.58	3253
Trachurus trecae	34.36	687	1.20	3254
Scomber japonicus	9.49	49	0.33	3255
Pomadasys incisus	7.36	22	0.26	
Sardinella maderensis	2.45	11	0.09	
Total	2856.20		100.00	

PROJECT STATION:1948  
 DATE:11/ 6/03 GEAR TYPE: PT No: 5 POSITION:Lat N 2217  
 start stop duration Long W 1653  
 TIME :14:37:53 14:52:36 15 (min) Purpose code: 1  
 LOG :6749.54 6750.61 1.06 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 44 47 Validity code:  
 Towing dir: 280e Wire out: 120 m Speed: 42 kn\*10  
 Sorted: 35 Kg Total catch: 883.22 CATCH/HOUR: 3532.88

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	2697.60	20640	76.36	3257
Sardina pilchardus	684.48	57504	19.37	3256
Scomber japonicus	78.80	420	2.23	3260
Sardinella aurita	61.60	384	1.74	3258
Decapterus rhonchus	7.64	56	0.22	3259
Trachurus trecae	1.40	4	0.04	
Sardinella maderensis	1.36	4	0.04	
Total	3532.88		100.00	

PROJECT STATION:1949  
 DATE:11/ 6/03 GEAR TYPE: PT No: 7 POSITION:Lat N 2209  
 start stop duration Long W 1653  
 TIME :17:10:21 17:42:18 32 (min) Purpose code: 1  
 LOG :6771.01 6773.12 2.04 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 30 39 Validity code:  
 Towing dir: 350e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 29 Kg Total catch: 58.38 CATCH/HOUR: 109.46

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	85.69	784	78.28	3262
Sardina pilchardus	21.86	1076	19.97	3261
Decapterus rhonchus	1.13	9	1.03	
Scomber japonicus	0.79	4	0.72	
Total	109.47		100.00	

PROJECT STATION:1950  
 DATE:11/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2214  
 start stop duration Long W 1717  
 TIME :21:04:35 21:07:02 2 (min) Purpose code: 1  
 LOG :6804.52 6804.65 0.13 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 92 92 Validity code:  
 Towing dir: 108e Wire out: 130 m Speed: 35 kn\*10  
 Sorted: 36 Kg Total catch: 722.00 CATCH/HOUR: 21660.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	15480.00	498600	71.47	3264
Trachurus trachurus	6180.00	201600	28.53	3263
Total	21660.00		100.00	

PROJECT STATION:1951  
 DATE:12/ 6/03 GEAR TYPE: PT No: 1 POSITION:Lat N 2204  
 start stop duration Long W 1716  
 TIME :00:26:52 00:55:02 28 (min) Purpose code: 1  
 LOG :6833.97 6835.96 2.01 Area code : 2  
 FDEPTH: 30 30 GearCond.code:  
 BDEPTH: 68 74 Validity code:  
 Towing dir: 280e Wire out: 120 m Speed: 43 kn\*10  
 Sorted: 30 Kg Total catch: 61.55 CATCH/HOUR: 131.89

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	117.00	4941	88.71	3266
Scomber japonicus	7.46	266	5.66	3265
Trichurus lepturus	3.21	6	2.43	
Sardina pilchardus	2.87	26	2.18	
Sardinella maderensis	0.79	2	0.60	
Sardinella aurita	0.56	2	0.42	
Total	131.89		100.00	

PROJECT STATION:1952  
 DATE:12/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2133  
 start stop duration Long W 1708  
 TIME :12:20:30 12:52:51 32 (min) Purpose code: 1  
 LOG :6947.01 6949.21 2.13 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 54 42 Validity code:  
 Towing dir: 95e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 28 Kg Total catch: 294.99 CATCH/HOUR: 553.11

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	534.38	2719	96.61	3268
Sardina pilchardus	12.94	98	2.34	3267
Sardinella maderensis	3.88	13	0.70	
Scomber japonicus	1.33	6	0.24	
Decapterus rhonchus	0.58	4	0.10	
Total	553.11		99.99	

PROJECT STATION:1953  
 DATE:12/ 6/03 GEAR TYPE: PT No: 5 POSITION:Lat N 2125  
 start stop duration Long W 1723  
 TIME :17:29:49 17:59:49 30 (min) Purpose code: 1  
 LOG :6992.78 6994.72 1.84 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 90 100 Validity code:  
 Towing dir: 272e Wire out: 120 m Speed: 39 kn\*10  
 Sorted: 32 Kg Total catch: 95.10 CATCH/HOUR: 190.20

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	76.20	738	40.06	3270
Sardina pilchardus	68.40	564	35.96	3269
Sardinella maderensis	45.60	144	23.97	3271
Total	190.20		99.99	

PROJECT STATION:1954  
 DATE:12/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2124  
 start stop duration Long W 1712  
 TIME :19:56:02 20:09:51 14 (min) Purpose code: 1  
 LOG :7010.73 7011.55 0.81 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 60 61 Validity code:  
 Towing dir: 278e Wire out: 125 m Speed: 35 kn\*10  
 Sorted: 34 Kg Total catch: 1981.22 CATCH/HOUR: 8490.94

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	3818.14	34136	44.97	3272
Sardinella aurita	3780.21	18964	44.52	3274
Trachurus trecae	783.86	36917	9.23	3273
Scomber japonicus	108.73	759	1.28	
Total	8490.94		100.00	

PROJECT STATION:1955  
 DATE:12/ 6/03 GEAR TYPE: PT No: 6 POSITION:Lat N 2124  
 start stop duration Long W 1705  
 TIME :21:51:29 22:04:34 13 (min) Purpose code: 1  
 LOG :7021.84 7022.65 0.79 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 38 42 Validity code:  
 Towing dir: 278e Wire out: 115 m Speed: 37 kn\*10  
 Sorted: 26 Kg Total catch: 189.93 CATCH/HOUR: 876.60

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	258.46	1131	29.48	
Sardinella maderensis	186.74	711	21.30	
Sardina pilchardus	164.77	2003	18.80	3275
Trachurus trecae	64.94	2326	7.41	3276
Diplodus bellottii	62.35	646	7.11	
Scomber japonicus	33.28	162	3.80	
Pagellus bellottii	29.72	291	3.39	
Trachurus trachurus	20.68	582	2.36	
Decapterus rhonchus	20.68	129	2.36	
Argyrosomus regius	10.52	14	1.20	
Diplodus sargus *	9.55	14	1.09	
Diplodus vulgaris	5.95	9	0.68	
Dentex gibbosus	4.85	32	0.55	
Spondyliosoma cantharus	1.66	5	0.19	
Loligo vulgaris	0.97	226	0.11	
Sepia officinalis hierredda	0.83	5	0.09	
Engraulis encrasicolus	0.65	65	0.07	
Total	876.60		99.99	

PROJECT STATION:1956  
 DATE:13/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2114  
 start stop duration Long W 1709  
 TIME :00:27:40 00:45:47 19 (min) Purpose code: 1  
 LOG :7044.16 7045.38 1.20 Area code : 2  
 FDEPTH: 5 5 GearCond.code:  
 BDEPTH: 45 41 Validity code:  
 Towing dir: 92e Wire out: 110 m Speed: 40 kn\*10  
 Sorted: 41 Kg Total catch: 617.01 CATCH/HOUR: 1948.45

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	720.00	3647	36.95	3278
Sardinella maderensis	644.21	2368	33.06	3279
Trachurus trecae	336.32	13074	17.26	3277
Decapterus rhonchus	127.42	947	6.54	
Sardina pilchardus	92.37	805	4.74	
Trachurus trachurus	21.32	663	1.09	
Scomber japonicus	3.66	25	0.19	
Sepia officinalis hierredda	1.14	3	0.06	
Pagellus bellottii	0.79	3	0.04	
Sepia orbignyana	0.60	3	0.03	
Illex coindetii	0.06	3		
Total	1947.89		99.96	

PROJECT STATION:1957  
 DATE:13/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2105  
 start stop duration Long W 1734  
 TIME :05:21:09 05:36:27 15 (min) Purpose code: 1  
 LOG :7088.53 7089.56 1.01 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 208 233 Validity code:  
 Towing dir: 270e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 33 Kg Total catch: 660.91 CATCH/HOUR: 2643.64

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trachurus	1226.40	17280	46.39	3282
Trachurus trecae	753.60	5600	28.51	3281
Scomber japonicus	656.00	4800	24.81	3280
Merluccius senegalensis	7.12	4	0.27	
Illex coindetii	0.52	4	0.02	
Total	2643.64		100.00	

PROJECT STATION:1958  
 DATE:13/ 6/03 GEAR TYPE: PT No: 5 POSITION:Lat N 2055  
 start stop duration Long W 1725  
 TIME :12:00:17 12:27:08 27 (min) Purpose code: 1  
 LOG :7149.20 7150.91 1.69 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 72 58 Validity code:  
 Towing dir: 90e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 38 Kg Total catch: 1568.10 CATCH/HOUR: 3484.67

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardina pilchardus	3137.78	20800	90.05	3283
Scomber japonicus	232.89	1689	6.68	3284
Sardinella maderensis	51.36	164	1.48	3286
Sardinella aurita	48.57	240	1.40	3285
Sarda sarda	13.78	33	0.40	
Total	3484.68		100.01	

PROJECT STATION:1959  
 DATE:13/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2048  
 start stop duration Long W 1732  
 TIME :21:48:04 21:56:19 8 (min) Purpose code: 1  
 LOG :7221.43 7221.93 0.50 Area code : 2  
 FDEPTH: 10 10 GearCond.code: 7  
 BDEPTH: 82 84 Validity code: 9  
 Towing dir: 270e Wire out: 125 m Speed: 37 kn\*10  
 Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
N O C A T C H				

PROJECT STATION:1960  
 DATE:13/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2048  
 start stop duration Long W 1732  
 TIME :22:16:57 22:21:02 4 (min) Purpose code: 1  
 LOG :7222.98 7223.23 0.25 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 83 82 Validity code:  
 Towing dir: 69e Wire out: 125 m Speed: 37 kn\*10  
 Sorted: 32 Kg Total catch: 640.66 CATCH/HOUR: 9609.90

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	8055.00	426300	83.82	3287
Sardina pilchardus	1380.00	10200	14.36	3288
Scomber japonicus	153.00	1800	1.59	
Illex coindetii	21.90	75	0.23	
Total	9609.90		100.00	

PROJECT STATION:1961  
 DATE:14/ 6/03 GEAR TYPE: PT No: 4 POSITION:Lat N 2048  
 start stop duration Long W 1717  
 TIME :00:18:21 00:32:44 14 (min) Purpose code: 1  
 LOG :7238.35 7239.30 0.93 Area code : 2  
 FDEPTH: 10 10 GearCond.code:  
 BDEPTH: 46 50 Validity code:  
 Towing dir: 270e Wire out: 120 m Speed: 40 kn\*10  
 Sorted: 32 Kg Total catch: 206.14 CATCH/HOUR: 883.46

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	421.71	1389	47.73	3292
Trachurus trecae	275.14	11623	31.14	3290
Sardina pilchardus	92.79	643	10.50	3289
Trachurus trachurus	46.03	1620	5.21	3291
Sardinella aurita	43.20	193	4.89	
Scomber japonicus	3.69	64	0.42	
Decapterus rhonchus	0.56	4	0.06	
Loligo vulgaris	0.21	9	0.02	
Dicologlossa hexophthalma	0.13	4	0.01	
Total	883.46		99.98	

### Annex III Instruments and fishing gear used

The Simrad EK-500, 38kHz echo scientific sounder was used during the survey for fish abundance estimation. The Bergen Echo Integrator system (BEI) logging the echogram raw data from the sounder, was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape, and a backup of the database of scrutinized data, stored. The details of the settings of the 38kHz were as follows:

<b>Transceiver-1 menu</b>	Transducer depth	5.5 m
	Absorption coeff.	10 dB/km
	Pulse length	medium (1ms)
	Bandwidth	wide
	Max power	2000 Watt
	2-way beam angle	-21.0 dB
	SV transducer gain	27.01 dB
	TS transducer gain	27.14 dB
	Angle sensitivity	21.9
	3 dB beamwidth along.	6.8°
	3 dB beamwidth athw.	6.8°
	Alongship offset	-0.05°
	Athwardship offset	0.09°
<b>Display menu</b>	Echogram	1
	Bottom range	10 m
	Bottom range start	9 m
	TVG	20 log R
	Sv colour min	-67 dB
	TS Colour minimum	-60 dB
<b>Printer- menu</b>	Range	0-50, 0-100, 0-150, 0-250 or 0-500m
	TVG	20 log R
	Sv colour min	-60 dB
<b>Bottom detection menu</b>	Minimum level	-40 dB

A calibration experiment using a standard copper sphere was performed in Langstrand, Namibia on 22 April 2003.

#### Fishing gear

The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super" bottom trawl. For all trawls, the Tyborøn, 7.8m<sup>2</sup> (1670 kg) trawl doors were used.

## Annex IV Regional estimates, May-July 2003

Sardine (*Sardina pilchardus*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6		4.8					4.8
7	162.2	84.8					247.0
8	1 731.9	394.0	11.4	220.7			2 358.1
9	1 694.8	1 048.5	295.5	6 377.5			9 416.3
10	208.1	1 105.2	848.3	8 255.1			10 416.6
11	7.9	3 638.6	2 133.0	3 876.2			9 655.6
12	35.6	5 541.1	3 226.4	531.0			9 334.0
13	336.0	3 969.2	1 391.8				5 697.1
14	1 709.6	1 880.8	983.4				4 573.7
15	5 896.3	291.4	1 132.9				7 320.7
16	8 222.0	46.8	414.6				8 683.4
17	3 754.7	418.4					4 173.1
18	1 493.6	2 098.9					3 592.5
19	1 334.4	2 877.7					4 212.1
20	450.6	12 510.9	25.5				12 987.0
21	59.1	16 102.0	93.3				16 254.4
22		11 533.1	129.9	38.6			11 701.6
23	68.9	8 714.6	318.1	38.6			9 140.3
24	84.3	6 013.1	647.4	77.2			6 821.9
25	7.7	2 048.6	722.7	386.0			3 164.9
26		473.5	218.4	193.0			884.9
27		36.1	29.1	308.8			374.0
28		3.2		77.2			80.4
29		1.5					1.5
30							
Total	27 257.5	80 836.9	12 621.7	20 379.8			141 096.0

Sardine (*Sardina pilchardus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6		11					11
7	561	293					855
8	8 722	1 984	58	1 111			11 875
9	11 915	7 372	2 077	44 837			66 201
10	1 975	10 491	8 052	78 362			98 880
11	99	45 377	26 601	48 340			120 417
12	570	88 743	51 673	8 504			149 490
13	6 778	80 080	28 081				114 939
14	42 737	47 017	24 583				114 337
15	180 050	8 899	34 594				223 543
16	302 859	1 725	15 273				319 857
17	165 006	18 388					183 394
18	77 545	108 974					186 519
19	81 136	174 970					256 106
20	31 830	883 823	1 800				917 453
21	4 815	1 312 230	7 603				1 324 648
22		1 077 228	12 136	3 605			1 092 969
23	7 336	927 400	33 853	4 108			972 696
24	10 160	725 117	78 067	9 309			822 654
25	1 041	278 543	98 263	52 481			430 329
26		72 251	33 335	29 450			135 036
27		6 153	4 967	52 659			63 779
28		603		14 654			15 256
29		310					310
30							
Total	935 135	5 877 983	461 016	347 420			7 621 555

## Annex IV continued

Round sardinella (*Sardinella aurita*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11			225.3				225.3
12			1 305.2	12.5			1 317.7
13			2 409.3	8.3			2 417.6
14			864.1	4.2			868.3
15			765.2	4.2			769.4
16			211.0				211.0
17			82.2				82.2
18			8.9				8.9
19							
20							
21							
22						1.3	1.3
23		4.2		1.2		3.9	9.2
24		28.6		4.6		5.1	38.3
25		157.5		3.5		16.7	177.7
26		345.4		20.1	35.4	25.7	426.5
27		323.3		21.0	72.9	20.6	437.8
28		262.4		74.7	66.0	11.6	414.6
29		173.0		187.5	22.3		382.7
30		206.1		236.0	15.9		457.9
31		13.3		244.1	23.4		280.8
32		45.5		198.3	21.4		265.2
33		69.2		244.1	21.4		334.7
34		81.4		106.3	9.7		197.4
35		100.8		37.4	7.8		146.0
36		57.0		17.1	3.9		78.1
37		37.9		5.3	5.8		49.0
38		11.8		2.6	1.9		16.4
39		21.6			1.9		23.6
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		1 938.9	5 871.3	1 432.9	309.8	84.8	9 637.8

## Annex IV continued

Round sardinella (*Sardinella aurita*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11			3 289				3 289
12			24 473	234			24 708
13			56 907	197			57 103
14			25 289	122			25 411
15			27 355	149			27 504
16			9 097				9 097
17			4 232				4 232
18			544				544
19							
20							
21							
22						140	140
23		514		144		480	1 138
24		3 952		651		726	5 328
25		24 552		550		2 659	27 761
26		60 416		3 593	6 316	4 591	74 915
27		63 202		4 187	14 561	4 104	86 055
28		57 090		16 599	14 661	2 570	90 920
29		41 740		46 214	5 488		93 441
30		54 964		64 278	4 321		123 563
31		3 910		73 248	7 014		84 172
32		14 682		65 345	7 061		87 088
33		24 453		88 102	7 734		120 288
34		31 408		41 904	3 840		77 152
35		42 391		16 084	3 347		61 821
36		26 077		8 002	1 819		35 898
37		18 791		2 674	2 958		24 424
38		6 336		1 447	1 067		8 850
39		12 516			1 153		13 669
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		486 993	151 186	433 723	81 339	15 270	1 168 511

## Annex IV continued

Flat sardinella (*Sardinella maderensis*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10						5.3	5.3
11			77.0			31.7	108.6
12			615.8			52.8	668.6
13			446.5			84.9	531.4
14			354.1			22.1	376.2
15			184.7			49.6	234.3
16			182.9			46.2	229.1
17			529.6			51.8	581.4
18			820.9			85.7	906.5
19			211.8	1.2		192.8	405.8
20			132.4	3.6		290.8	426.8
21			158.9	5.9		302.9	467.7
22			317.8	19.0		413.0	749.8
23			185.4	16.6		629.2	831.2
24			79.4	18.1	7.7	771.6	876.8
25				17.7	8.8	371.1	397.6
26				49.7	9.9	334.0	393.5
27		4.9		51.1	8.8	179.5	244.4
28		14.8		53.5	11.0	121.4	200.7
29		52.3		35.3	6.6	30.1	124.3
30		124.5		20.9	2.2	43.6	191.2
31		131.7		5.3	1.1	9.5	147.6
32		140.7		13.2		47.6	201.5
33		130.0		5.3		47.6	182.9
34		119.9		5.3		9.5	134.7
35		51.0				9.5	60.5
36		2.4				9.5	11.9
37							
38							
39							
40		0.2					0.2
41		0.2					0.2
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		772.7	4 297.2	321.6	56.2	4 243.2	9 690.9



## Annex IV continued

Flat sardinella (*Sardinella maderensis*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10						59	59
11			1 124			462	1 586
12			11 546			989	12 536
13			10 545			2 006	12 551
14			10 363			648	11 011
15			6 604			1 772	8 376
16			7 887			1 992	9 880
17			27 248			2 666	29 914
18			49 897			5 206	55 103
19			15 080	85		13 725	28 890
20			10 950	295		24 053	35 298
21			15 159	567		28 896	44 621
22			34 747	2 080		45 163	81 990
23			23 094	2 073		78 386	103 553
24			11 215	2 554	1 089	108 928	123 786
25				2 817	1 403	59 068	63 288
26				8 871	1 771	59 664	70 307
27		998		10 204	1 760	35 839	48 801
28		3 334		11 887	2 448	26 969	44 638
29		13 034		8 691	1 629	7 424	30 778
30		34 273		5 684	600	11 883	52 439
31		39 928		1 585	331	2 857	44 700
32		46 854		4 352		15 689	66 896
33		47 419		1 907		17 182	66 508
34		47 766		2 083		3 753	53 602
35		22 125				4 089	26 215
36		1 142				4 445	5 587
37							
38							
39							
40		102					102
41		109					109
42							
43							
44							
45							
46							
47							
48							
49							
50							
<b>Total</b>		257 084	235 460	65 733	11 031	563 814	1 133 123

## Annex IV continued

Anchovy (*Engraulis encrasicolus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5	124.7						124.7
6	407.3	1.6					408.9
7	333.9	46.2		95.8			475.9
8	354.1	101.3		583.4			1 038.8
9	258.8	44.1		1 486.6			1 789.4
10	206.8	16.0	11.8	2 350.9			2 585.5
11	401.5	2.2	1 054.5	4 225.3			5 683.4
12	880.6	1.7	2 000.5	5 062.1			7 945.0
13	1 190.9	0.4	506.7	1 313.3			3 011.3
14	523.7	0.4	63.4	87.4			675.0
15	95.3						95.3
16	5.0						5.0
17							
18							
19							
20							
Total	4 782.6	213.9	3 636.9	15 204.8			23 838.2

Anchovy (*Engraulis encrasicolus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5	112						112
6	604	2					606
7	761	105		218			1 084
8	1 174	336		1 935			3 445
9	1 198	204		6 883			8 285
10	1 293	100	74	14 696			16 162
11	3 297	18	8 660	34 701			46 676
12	9 288	18	21 099	53 390			83 795
13	15 822	6	6 731	17 449			40 008
14	8 621	7	1 044	1 439			11 111
15	1 916						1 916
16	122						122
17							
18							
19							
20							
Total	44 208	796	37 609	130 709			213 323

## Annex IV continued

Atlantic horse mackerel (*Trachurus trachurus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7			2.2				2.2
8	22.7		34.6				57.3
9	79.4		123.4				202.8
10	17.0		1 240.8				1 257.9
11		2.9	444.8				447.8
12	1.1	5.9	30.0				37.1
13		19.1	10.0				29.1
14		29.9					29.9
15		136.1					136.1
16		293.7					293.7
17		502.2					502.2
18		1 018.6					1 018.6
19		1 078.3					1 078.3
20		607.8					607.8
21		144.4					144.4
22		38.0					38.0
23		14.8					14.8
24		7.8					7.8
25		45.6					45.6
26		72.4					72.4
27		72.3					72.3
28		36.7					36.7
29		38.5					38.5
30		29.8					29.8
31		31.4					31.4
32		27.9					27.9
33	1.7	22.7					24.4
34							
35	3.8						3.8
36	2.1						2.1
37	1.7						1.7
38	5.4						5.4
39	2.7						2.7
40	24.9						24.9
41	4.9						4.9
42	9.0						9.0
43	12.3						12.3
44	1.8						1.8
45							
46							
47							
48							
49							
50							
Total	190.5	4 277.0	1 885.8				6 353.3

## Annex IV continued

Atlantic horse mackerel (*Trachurus trachurus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7			9				9
8	117		204				321
9	572		1 015				1 587
10	166		13 790				13 955
11		38	6 495				6 532
12	19	97	563				678
13		395	236				632
14		764					764
15		4 256					4 256
16		11 083					11 083
17		22 609					22 609
18		54 177					54 177
19		67 165					67 165
20		43 985					43 985
21		12 052					12 052
22		3 635					3 635
23		1 617					1 617
24		961					961
25		6 354					6 354
26		11 315					11 315
27		12 636					12 636
28		7 146					7 146
29		8 311					8 311
30		7 101					7 101
31		8 255					8 255
32		8 043					8 043
33	544	7 167					7 710
34							
35	1 428						1 428
36	849						849
37	762						762
38	2 578						2 578
39	1 373						1 373
40	13 885						13 885
41	2 970						2 970
42	5 779						5 779
43	8 478						8 478
44	1 325						1 325
45							
46							
47							
48							
49							
50							
Total	40 845	299 163	22 312				362 320

## Annex IV continued

Cunene horse mackerel (*Trachurus trecae*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						0.9	0.9
5						0.4	0.4
6				171.5		2.5	174.0
7				693.2	4.4	16.1	713.7
8				541.2	21.4	44.8	607.5
9				2 484.6	75.2	39.9	2 599.8
10		17.9		4 692.2	95.8	34.2	4 840.1
11		170.2	18.2	1 667.4	85.3	24.6	1 965.6
12		454.1	118.5	465.8	21.7	83.4	1 143.5
13		1 603.5	1 026.6	328.7	4.2	9.5	2 972.5
14		1 889.7	1 462.9	2 071.8		1.5	5 425.9
15		1 458.3	1 610.8	1 628.4		1.5	4 699.0
16		620.9	744.4	601.9		2.2	1 969.5
17		242.7	321.6	115.3	8.4	4.2	692.3
18		57.6	86.6	67.5	25.7	49.7	287.1
19		11.5		67.5	74.7	162.8	316.5
20		19.1			139.3	242.4	400.9
21		3.1			118.5	147.0	268.6
22					75.0	169.5	244.4
23		8.0			22.3	65.1	95.4
24		24.2			3.7	9.3	37.2
25		61.3					61.3
26		60.3					60.3
27		36.0					36.0
28		7.9					7.9
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
<b>Total</b>		6 746.4	5 389.6	15 597.3	775.6	1 111.4	29 620.3

## Annex IV continued

Cunene horse mackerel (*Trachurus trecae* ), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						1	1
5						1	1
6				452		6	459
7				2 808	18	65	2 891
8				3 191	126	264	3 581
9				20 450	619	329	21 398
10		174		52 145	1 065	380	53 764
11		2 174	266	24 345	1 245	359	28 389
12		7 450	2 222	8 733	407	1 564	20 376
13		33 141	24 247	7 765	98	224	65 475
14		48 391	42 813	60 636		44	151 884
15		45 617	57 584	58 214		54	161 469
16		23 430	32 104	25 957		95	81 585
17		10 926	16 548	5 934	434	214	34 055
18		3 065	5 265	4 104	1 562	3 019	17 015
19		716		4 806	5 321	11 588	22 431
20		1 384			11 525	20 052	32 960
21		255			11 311	14 023	25 588
22					8 199	18 530	26 729
23		876			2 776	8 112	11 764
24		2 994			524	1 313	4 831
25		8 539					8 539
26		9 424					9 424
27		6 285					6 285
28		1 545					1 545
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total		206 385	181 048	279 541	45 228	80 237	792 438

## Annex IV continued

False scad (*Caranx rhonchus* ), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						4.5	4.5
5						118.0	118.0
6						82.2	82.2
7						56.8	56.8
8						63.9	63.9
9						49.0	49.0
10						19.3	19.3
11						39.3	39.3
12						72.4	72.4
13						7.8	7.8
14						1.3	1.3
15						1.3	1.3
16						1.3	1.3
17							
18							
19							
20						5.2	5.2
21						16.0	16.0
22					3.2	43.9	47.1
23					1.6	44.7	46.3
24					1.6	12.0	13.7
25					1.6	21.5	23.1
26					6.4	7.7	14.1
27					19.3	5.1	24.4
28					11.3	0.7	12.0
29					9.6	5.1	14.7
30					4.9	8.6	13.5
31					5.8	13.0	18.8
32					3.3	17.3	20.6
33					5.9	8.6	14.5
34					2.5	4.3	6.8
35					3.3	4.3	7.7
36					1.7	4.3	6.0
37					0.8		0.8
38					1.7		1.7
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total					84.6	739.6	824.2

## Annex IV continued

False scad (*Caranx rhonchus* ), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
4						4	4
5						189	189
6						217	217
7						230	230
8						362	362
9						392	392
10						171	171
11						270	270
12						17	17
13							
14							
15							
16							
17							
18							
19							
20						431	431
21						1 527	1 527
22					352	4 803	5 155
23					200	5 571	5 771
24					227	1 700	1 927
25					256	3 426	3 682
26					1 149	1 369	2 519
27					3 853	1 011	4 864
28					2 502	164	2 666
29					2 378	1 248	3 626
30					1 332	2 356	3 688
31					1 738	3 893	5 631
32					1 103	5 701	6 803
33					2 114	3 122	5 235
34					989	1 705	2 694
35					1 437	1 857	3 295
36					781	2 019	2 800
37					424		424
38					917		917
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total					21 751	43 752	65 503



## Annex IV continued

Chub mackerel (*Scomber japonicus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11		63.2					63.2
12		11.0					11.0
13	42.0	15.3					57.4
14	497.1	101.6					598.7
15	231.0	216.7					447.8
16	21.0	223.6					244.6
17	0.8	97.7					98.5
18		44.3					44.3
19		32.8					32.8
20	5.9	54.1					60.0
21	16.8	91.3					108.1
22	29.2	123.9					153.0
23	61.0	165.0					226.0
24	43.8	182.2					226.0
25	5.1	109.0					114.2
26	14.5	103.4					117.8
27	4.9	180.5					185.4
28		277.2					277.2
29	1.0	147.6					148.5
30	0.5	117.2					117.6
31	11.8	47.9					59.7
32	13.9	38.6					52.5
33	9.9	28.8					38.7
34	2.0	11.0					13.0
35	4.0	9.7					13.7
36		1.8					1.8
37		6.9					6.9
38							
39		2.7					2.7
40		0.1					0.1
41		3.3					3.3
42		3.2					3.2
43		0.1					0.1
44		0.3					0.3
45		0.3					0.3
46		0.3					0.3
47		0.2					0.2
48		0.1					0.1
49		0.1					0.1
50		0.1					0.1
Total	1 016.0	2 513.1					3 529.1

## Annex IV continued

Chub mackerel (*Scomber japonicus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10							
11		807					807
12		181					181
13	868	317					1 185
14	12 729	2 603					15 332
15	7 227	6 780					14 007
16	793	8 436					9 229
17	36	4 400					4 436
18		2 357					2 357
19		2 041					2 041
20	427	3 915					4 342
21	1 402	7 622					9 024
22	2 789	11 851					14 640
23	6 651	17 990					24 641
24	5 405	22 512					27 917
25	716	15 185					15 902
26	2 263	16 159					18 422
27	851	31 534					32 385
28		53 903					53 903
29	207	31 825					32 032
30	114	27 925					28 039
31	3 110	12 564					15 674
32	4 000	11 132					15 132
33	3 115	9 100					12 215
34	684	3 788					4 471
35	1 489	3 660					5 149
36		754					754
37		3 078					3 078
38							
39		1 385					1 385
40		32					32
41		1 979					1 979
42		2 055					2 055
43		40					40
44		213					213
45		273					273
46		243					243
47		207					207
48		55					55
49		117					117
50		62					62
<b>Total</b>	<b>54 877</b>	<b>319 079</b>					<b>373 956</b>